NOVEMBER

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

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EDITORIALS
The Washington Meeting
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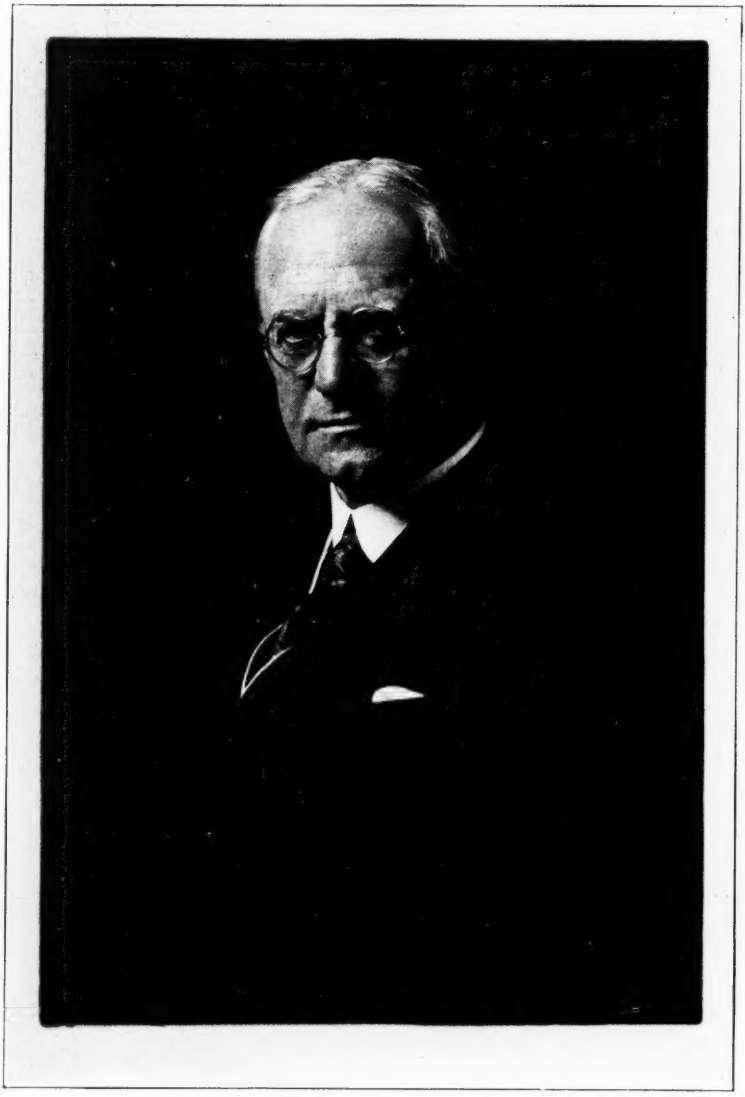

MR. GEORGE EASTMAN
Philanthropist and Friend of Dentistry

UNIV. OF MICH.

THE JOURNAL
of the AMERICAN DENTAL ASSOCIATION

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Original Communications

THE TRAINING OF DENTAL TECHNICIANS*

By HENRY L. BANZHAF, B.S., D.D.S., F.A.C.D., Milwaukee, Wis.

WHILE the training of dental technicians is not one of the outstanding problems with which we as dental educators are confronted at this time, I felt, nevertheless, that there had been enough interest manifested recently on the part of those who are occupied in dental education to prompt me to accept the invitation to appear on this program for the suggested purpose of presenting an analysis of the whole question of the relationship of the recognized dental school to the dental technician and the commercial dental laboratory.

I believe that we are all agreed that the dental technician is one of the most valuable assistants that the busy dentist may call to his aid in his endeavors to give efficient health service to his patients. With the assistance of the technician, the dentist may relieve himself of many highly exacting mechanical procedures, and thus conserve his time for diagnosis and intra-oral service. In fact, I believe that it is a conservative statement to say that the working efficiency of the average busy dentist would be decreased very materially were he unable to depend on the assistance and cooperation of the dental technician.

Are dentists satisfied with the service that they are receiving from dental technicians? Could the dental schools of the country increase the efficiency of the dental laboratories were they to lend their facilities to this end? Perhaps so. But the whole question presents, as we shall see, so many angles and so many difficulties that it is not easy to give a definite and clear cut reply.

Please note that I do not, anywhere in this discussion, use the term "mechanical dentist" interchangeably with the term "dental technician" unless I am quoting from other sources. I am sure that all dental educators are unanimous in their disapproval of the use of the term mechanical dentist in this connection, since a technician is not *ipso facto* a dentist and cannot be called one by any stretch of the imagination.

Every dental technician today is working under one of three conditions: He is employed by a single dentist or a small

*Read at the General Session of the Sixth Annual Meeting of the American Association of Dental Schools, Chicago, Ill., March 27, 1929.

group of dentists; he is following his vocation in a small laboratory employing only a few individuals, or his services are engaged in a larger dental laboratory located in a metropolitan center. If he is working alone, employed by a single dentist or a group of dentists, he has only a limited opportunity for specialization. He must do all of the mechanical work incident to the practice of dentistry, including porcelain work, model making, casting, polishing, soldering, denture set-up, denture finishing, crown and bridge construction, and the making of regulatory and other special appliances. Likewise, he must have a complete knowledge of the manipulation of the various materials that are used. The dental technician working in a small dental laboratory which employs, let us say for example, three workmen may obviously specialize to a certain limited extent and thus develop a higher degree of skill in some particular operation such as porcelain manipulation and baking. The dental technician employed by a dental laboratory large enough to hire a sufficient number of men to make it possible as well as desirable to assign some particular type of work to the same individual continuously obviously has the best opportunity to perfect his technic and develop an astonishing degree of dexterity. On the whole, it is from those well-conducted laboratories that are of sufficient size to permit this specialization that the majority of dentists can expect to receive the most satisfactory service.

A well-organized dental laboratory which is conducted along the highest business principles, as it must be in order to continue a profitable existence, seems to me to be an ideal place for a young man who is mechanically inclined to learn some specialty of the dental technician's trade. In the best regulated of these laboratories, young men are admitted into the organization at the age of 17 or 18, often serving as messengers or delivery boys until a vacancy occurs in the laboratory. They are first taught the uses and manipulation of some of the simpler materials. The usual weekly wages of a boy starting in to learn the trade is from $12 to $14.

After showing a proper degree of proficiency, the apprentice is taught to polish and finish; and when opportunity presents, he is admitted as a beginner in some one of the departments of the laboratory in order to commence his training as a technician. Considerable attention is given to finding out in which specialty he is likely to become most proficient, and I am told that a young man must sometimes he changed from one department to another several times until he finally finds the work at which it is possible for him to develop the greatest skill. After he is thus definitely located, his work is confined to some one line of activity, such as denture set-up, porcelain work or bridgework. After working at his specialty for several years, doing the same operation over and over, he develops amazing skill. The proprietor of one of the large laboratories in one of our large cities, in whom I have great confidence, has estimated that, in the majority of cases, his employes reach the period of maximum skill and efficiency after being engaged in a given specialty for from five to eight years. Being well paid, the technician who is by nature fitted to develop a high degree of manual dexterity is usually happy and contented and in most cases he takes great pride and pleasure in his work.

In some of the largest and most efficiently organized of these dental laboratories, from eight to twelve technicians may be found busily engaged in each

department. A man trained to do one line of work is never called on to work in another department. This extreme specialization is not only necessary from the point of view of laboratory organization in order to avoid confusion, but it likewise makes for speed as well as precision and, as a result, the cost of the operation, notwithstanding the high wages of the skilled and experienced workmen, is cut to a minimum.

I have gone into this detail because it is necessary for us to understand clearly the nature of the activities in the most successful laboratories so that we may have a proper understanding of the problem that confronts the educational institution that may wish to attempt to train dental technicians. It is obvious that each dental technician, whether he is working alone in his own laboratory or is employed with two or three fellow workmen in a semidepartmentalized small laboratory or in a dental office under the immediate supervision of a dentist, must meet the same standards as to the quality of his service to the dental profession as the technician employed in the highly departmentalized and well-organized larger laboratory or be forced to a precarious if not unprofitable existence. For this reason, it is not uncommon to hear the complaint from the owners of the smaller laboratories that economic conditions in the dental laboratory business are becoming less and less satisfactory each year, while the large laboratories report an ever-increasing volume of business.

Success as a dental laboratory technician, therefore, demands the speed, precision and skill which usually is born of the experience made possible by repeated performance of the same operation. However, I freely admit that there are some dental technicians working alone or assisting a single dentist or a group of dentists in a dental office who are possessed of an unusual amount of natural inborn skill, and who may, as a result, develop the necessary ability to compete with the specialized laboratory in several, if not all, of the specialties of dental laboratory work. Such exceptions are, in my opinion, quite rare.

It is necessary to keep the facts that I have just discussed in mind when we consider in some detail their relationship to dental educational institutions.

Concerning the present proprietary schools of "mechanical dentistry," I desire to bring to your attention the resolution which was adopted by the House of Delegates of the American Dental Association at Minneapolis last August. This same resolution has likewise been passed by the Illinois State Dental Society, the Chicago Dental Society and the Nebraska State Dental Society. I believe that we may safely conclude, therefore, that it represents the consensus of opinion of the majority of members of the dental profession concerning these schools. I quote:

RESOLUTIONS

WHEREAS, several so-called "schools of mechanical dentistry" are now operating in the larger cities of the country, claiming to teach and ultimately graduate students as skilled technicians in "mechanical dentistry" or "dental art," in short courses which may be taken day or night and during which period of instruction the student will be able to follow other lines of work and "earn while he learns"; and

WHEREAS, it is recognized that it would be impossible for a student to obtain adequate education and acquire adequate skill and proficiency in the exacting requirements demanded of the dental technician at the present time in a short course, and under the supervision of teachers who could not themselves qualify either as licensed dentists or as skilled technicians; and

WHEREAS, such advertisements as are appearing in the daily papers of our larger cities, many magazines of nation-wide dis-

tribution, and radio station broadcasting are ambiguous, misleading and untruthful; and the propaganda used is for the sole purpose of obtaining students by proprietary schools conducted by laymen for revenue only; therefore, be it

Resolved, that the American Dental Association in regular meeting assembled condemns such schools as being merely commercial and unrecognized institutions, not in accord with higher dental education, and that members of the dental profession should refrain from encouraging untrained and unsophisticated young men and women to take up such courses.

I have examined the 1928 catalog of one of the most important of these schools with a great deal of interest. It is profusely illustrated and attractively printed and as a sales argument to the uninitiated is almost conclusive. It features many letters from successful graduates, showing them to be invariably prosperous. The course in this school has no specific length, although prospective students are informed that, with proper talent and application, they may learn the business in from four to six months, or from eight to twelve months, if they enroll in the evening sessions.

With respect to the opportunities for dental technicians, the owners of this school carefully avoid making any promises in the catalog to secure employment for their graduates. While they make the suggestion that their graduates may find employment with dentists in their private laboratories or with regular established dental laboratories, the statements in the catalog lay great emphasis on the thought that students will find it desirable to open their own laboratories. Assurance is given that students finishing the course have the ability to do this by reason of the training that they have received.

I have taken the trouble to ascertain whether the graduates of this school are employed by the established laboratories located in the same city and found not only that this was not the case but also that a definite antagonism toward such graduates existed. Furthermore, graduates of this or any other school are not to be found in the largest and most representative laboratories of a number of our large cities in this part of the country. The owners of all of these laboratories say that they prefer to develop their own technicians.

The greatest fault of the proprietary schools of "mechanical dentistry," as they call themselves, that are now in existence is the fact that they attempt to qualify the student as a laboratory technician competent to handle all departments of the work in a short course. Such an attempt, even if it were made in all sincerity, is, in my opinion, doomed to certain failure because it is attempting to accomplish an impossibility. While the proprietors of successful commercial laboratories, as I have already stated, are unanimous in the opinion that it usually takes from five to eight years to develop a technician to the point of real proficiency in a single specialty of dental technics, these short-course schools claim to cover the entire field in the space of less than a year.

In order to accomplish what these schools profess to do in the educational world, it would be necessary for them to revise the course of study, not only by increasing the length of the course materially, but also by departmentalizing the schools. If a student, on admission, would be required to choose a certain line of work just as the apprentice in the regular dental laboratory is asked to do, and if he were to receive a year or more of instruction and practice in that one division of the work, perhaps he might qualify sufficiently to be accepted as a workman in the office of a dentist or a

dental laboratory. A good porcelain man, an experienced finisher or a competent denture technician might expect to secure a position in a dental office or a laboratory. Any one possessing merely a superficial knowledge of a number of these specialties, I am informed, need not apply for a position to the average dental laboratory unless he is willing to start at $12 a week as an errand boy.

Were these proprietary schools of "mechanical dentistry" to revise their courses, they would, necessarily, be forced to close their doors almost immediately. They thrive because of the hope of a large number of Americans that the knowledge from which large profits may be made instantly can be gained in short courses almost overnight. Our magazines are full of advertisements of schools promising to convert their students into public speakers, detectives, musicians or high-powered salesmen merely by a few lessons given by means of correspondence. Unless these schools of "mechanical dentistry" promised their prospective students relatively large returns from a relatively small amount of effort to acquire the necessary proficiency, they could not long meet this competition.

Since the War, three recognized dental schools, namely Northwestern University, the University of Minnesota and the University of Nebraska, have established and later promptly discontinued departments for laboratory technicians. The course at Northwestern was established at the request of the United States Government Vocational Training Bureau and was continued as long as there were any members of the Veterans Bureau who wished to take it. According to the dean, the course was twelve months in length and included the essential features of the prosthetic technic laboratory course, together with lectures and demonstrations in chemistry and metallurgy. The course at Minnesota was continued for but one year. The dean of this school states that those who completed the course had difficulty in securing positions and the majority of them have gone into some other line of work. The dean further states: "At the present time, we do not feel that there is any reason whatever for reestablishing the course, and we do not plan to do so." The course at Nebraska was organized and discontinued during the session 1925-1926.

Our esteemed president, in his capacity as dean of the dental school of the University of Southern California, made an interesting experiment along this line some years ago, discontinuing the course when he felt that a sufficient number of graduates had been placed in the field and reestablishing the course again last fall. At that institution, a course for dental technicians is offered one calendar year in length although an increase to sixty weeks is contemplated. Eight students are enrolled, receiving their instruction in technics including prosthetics, crowns and bridgework, casting and ceramics from an experienced full-time laboratory technician and their lectures and instruction in anatomy of the head and neck, physics, chemistry, metallurgy and dental anatomy from the members of the regular dental faculty.

The interesting information is given that the graduates of the course that was conducted several years ago are now the owners of most of the dental laboratories in that section of the country. I am told that they are much better trained than the boys who go into the laboratory as apprentices, because the latter have little opportunity to learn more than the particular type of work that the owner or proprietor of the laboratory sets them

to do. The assertion is made that the young men who finish the course will be sought after by dental laboratories if they do not open laboratories of their own, and that, as a result of their contacts in the dental school, the students will necessarily absorb principles of ethics and adopt more of a professional attitude toward their work and toward the members of the dental profession as a whole.

While these observations are in almost total variance with the facts that I have collected and observations that I have made in the East and in the Middle West, I do not wish for one moment to question the wisdom of the educational plan that has been suggested to fill the need that I am told exists in California. All other dental schools will study the particular methods used at the University of Southern California College of Dentistry with great interest, so that when the need for such courses arises in this section of the country, we will be able to establish successful courses and profit by the experience gained.

As I have intimated, undoubtedly some of the members of this association are better qualified than I am to give you an authoritative opinion as to the content of a course for dental technicians in a recognized dental school. My remarks are the result merely of investigation and study and not the result of first hand experience. Although there may be a wide difference of opinion as to the specific content of the courses that might be offered, we must, in my judgment, adopt and agree on two fundamental principles when organizing a department for the training of dental technicians in dental schools:

First, the school must be departmentalized. Each student should, on admission, be required to chose his specialty (or have his specialty chosen for him by the faculty by means of certain tests following a short preliminary period), whether that be bridgework, denture setup, denture construction and finishing, ceramics, special appliance making or any other one of the specialties of the dental laboratory trade. In addition, the student may be given courses in such subjects as dental anatomy, metallurgy and business ethics. Secondly, the school must require a sufficient amount of time, the exact length to be determined by experimentation, so that the graduate may be trained to produce the precise and finished work in his specialty that is at present being produced in the highly departmentalized dental laboratory. Equipped with adequate skill, a graduate might reasonably expect to find employment as an assistant in a dental laboratory or he might associate himself with a number of technicians, each individual of the group being trained along a different line so that the composite organization might compete with the modern dental laboratory of today.

Now as to whether, in my opinion, there is a need for training of specialized dental technicians by regular dental schools, my reply, at least as far as the northern central states are concerned, is in the negative. The actions of the faculties at Northwestern, Minnesota and Nebraska are, I believe, significant. More important in this connection is the fact that there is, as far as I can learn, absolutely no demand for such courses on the part of reputable dental laboratories. Each laboratory, I find, has a system of apprenticeship which is amply adequate to meet the present demand for new technicians, and it could only be in a large departmentalized dental laboratory that the graduate of our hypothetical school could hope to secure employment. I may add in passing that there seems to

be no need for more dental laboratories. Among the smaller dental laboratories, there is a general complaint that business is decreasing and less profitable. On the other hand, as I have already pointed out, the larger highly departmentalized laboratories are in general prosperous, and some of them highly so, although none of them are taxed to such an extent as to prevent them from giving prompt service. The members of the dental profession, in general, are patronizing the small one or two man laboratory only under exceptional circumstances. In order that I may not be misunderstood, I desire to make the definite statement that I am quite aware of the fact that there are among the number of small dental laboratories, some that are conducted by unusually skilful workmen who are giving highly satisfactory service. As a rule, as I have already stated, a dental laboratory must be conducted by a sufficient number of technicians so that it may be departmentalized if it is to compete with the highly organized larger laboratory either economically or with respect to the quality of its work.

Then, too, there is a question of educational organization involved. Should universities engage in the training of those who desire to learn the trades, unless in times of special emergency or unless extraordinary conditions make it imperative? Are the problems of our institutions of higher education not already sufficiently complex? Should our engineering schools, in addition to training professional engineers versed in higher mathematics and the theory and science of their profession, also train carpenters, plumbers or molders? Should our medical schools offer courses in the manufacture of crutches, artificial limbs or artificial eyes for young men who desire to follow those trades? Should our colleges of journalism graduate printers, linotype operators and telegraphers? And may we not inquire with an equal amount of doubt whether our dental schools should prepare young men for the trade of dental technician?

The establishment of courses for dental technicians of the nature and length that I have described in reputable dental schools would, I believe, have little effect on the prosperity or student-drawing power of the present proprietary schools of "mechanical dentistry" that we all condemn. All that the reputable school could offer its graduates after completing a long and exacting course would be an opportunity to get a job in a dental office or a dental laboratory at wages which might or might not be attractive, while the proprietary schools conducted for profit would continue to promise a golden harvest to their graduates at the end of a short course. As for any regulations that the Dental Educational Council might make for such unrecognized schools, any attempted supervision would undoubtedly be resented and promptly disregarded. Unless backed up by legislative action in a majority of the states, making it legally impossible to conduct short-course schools, these institutions would still continue to exist as a trap for the ignorant and uninformed. Let me point out that schools of chiropractic, short-course schools purporting to train engineers and short-course law schools have recently become less popular with the type of American youth who craves a quickly obtained education. The advertisements in our popular magazines tell us in attractive headlines that we have with us a new crop of schools that guarantee to produce public speakers, musicians, high salaried accountants or automobile mechanics with a minimum expenditure of effort and time. The

expression "earn while you learn" has become to be almost a national byword. And let me predict that as soon as our present proprietary schools of "mechanical dentistry" have passed from posterity to oblivion, their places in the commercial educational scheme will be ably and just as notoriously filled by institutions making perhaps far more glittering promises. Is it not reasonable to suppose that this state of affairs will continue until the youth of the country is finally convinced that education is a long and painful process from which only reasonably modest financial returns may be expected?

Another matter that is of considerable interest in this connection is the question as to whether dental technicians should be licensed by the state. It is pointed out that all persons practicing in the professions whose chief concern is the health of the public are subject to licensure. Also, that members of certain recognized trades such as plumbers and barbers are under state supervision. There is a striking difference between the character of the service supplied by a plumber or a barber and the service performed by a dental technician. The plumber or barber works directly for the public and any infraction of certain established rules may mean discomfort or disease. The dental technician does not work for the public but for the dentist whose directions he follows. The responsibility for the health of the patient lies entirely with the dentist. There is, in my opinion, no more valid reason for licensing the dental technician than there would be to license the workman who makes artificial limbs for the physician.

For the same reasons, in my opinion, there is no necessity for licensing dental laboratories, notwithstanding the fact that many proprietors of dental laboratories now in existence would be glad to have the field restricted by such means. To license the dental laboratories would give no added protection to either the dentist or the public. The degree of efficiency of the health service with which a dentist serves the public depends on his own judgment and ability, not on the judgment and ability exercised in the dental laboratory. Any prosthetic appliances manufactured for the dentist in the dental laboratory are subject to acceptance or rejection by the dentist. Any dental laboratory that does not employ skilled specialists as dental technicians obviously cannot meet the dentist's expectations or specifications as closely as the dental laboratory that is capable of offering such services, and hence will be eliminated in due time by the fierce competition that exists in this business. Dental laboratories capable of meeting this competition are being so well patronized that they do not need the extra encouragement that a state license would give.

I do not like to leave any subject that I have been asked to discuss without offering a few thoughts that are constructive. As a result of my analysis, thus far in this paper I have found it necessary to say "thumbs down" on practically every proposition that has been incident to the discussion. Together with the great majority of dentists, I have disapproved of the present proprietary schools for "mechanical dentists"; I have pointed out that several reputable schools for dental technicians in this part of the country have been discontinued; I have intimated that there is no need for such schools in the central states; I have not favored the licensing of either dental technicians or the laboratories where they are employed. About the only thing of which I have approved is the experiment being conducted at the Southern Cali-

fornia College of Dentistry for the purpose of filling a regional need that seems to exist in that part of the country. For my own satisfaction, if for no other motive, I should like to consider briefly the question: What can we do as dental educators to enable the dental technician to give better service?

The proprietors of the dental laboratories of whom I asked this question were unanimous in the opinion that teamwork between the dentist and dental technician has improved greatly during the past ten years. Recent dental graduates have been trained to a better understanding of the properties and characteristics of a good impression and of the necessity for an accurate study model for each case requiring prosthetic replacements. Despite this noticeable improvement, much remains to be done.

In papers that I have read before this body since its organization in 1923, I have repeatedly stressed the thought that, in our courses in crowns and bridgework, prosthetic technics and other technical courses, dental teachers have been making the mistake of insisting on a multiplicity of technic pieces rather than devoting their time to the teaching of fundamental principles. Merely for the purpose of giving the students a little additional manual dexterity, our teachers have been forcing the blind repetition of certain exercises rather than requiring the student to look on these technical procedures as the exemplification of certain fundamental principles. Among these underlying principles that have been slighted as a result of this practice are those relating to occlusion and to impression taking. A dental graduate who possesses a knowledge of these fundamentals will give the dental technician an impression that is as carefully, neatly and scientifically made as is possible in the light of our present knowledge. With specifications concerning which he can have no doubt or hesitancy, the dental technician has the opportunity to manufacture a denture, a bridge or a crown that will, from the point of view of esthetics and adaptation as well as of service, approximate nature as closely as possible.

In our teaching, we cannot emphasize the matter of oral diagnosis too much. In addition to the necessary roentgenograms and bacteriologic and pathologic examinations, the necessity and value of precise, clean-cut study models of the mouth should be stressed. Only by means of an accurately made study model is it possible to arrive at a correct determination of the style and type of a prosthetic restoration that should be employed and the factors that must be kept in mind to maintain normal occlusion. A dentist who is in the habit of making careful study models is just as careful when issuing his directions to the laboratory technician, and the technician is thereby enabled to put forth his best efforts.

During the time that a student is enrolled in the dental school, it is impossible to make of him an expert dental technician as well as a graduate dentist. It is only possible to train him sufficiently in each technical division that he may become a safe beginner in the practice of his profession. It is also possible to give him the skill and knowledge of laboratory methods necessary to enable him to complete the ordinary technic pieces required in the usual general practice of dentistry. It is unlikely, unless special circumstances are present, that the dental graduate will attain the skill that is reached by the dental technician who has, for example, worked at nothing but casting over a period of five or six years. It is possible to give the dental student a working knowledge of fundamental principles

which will enable him first to diagnose oral conditions, then to acquaint the dental technician of his findings by means of accurate study models and impressions, and finally to direct, supervise and pass on the work of the dental technician intelligently.

A further activity in which dental schools may effectively engage for the purpose of perfecting teamwork between the dentist and the dental technician, which was suggested by William J. Gies on page 82 of the recent Carnegie Bulletin, is to offer "advanced courses for dental technicians in small groups carefully selected for their mechanical ability." The presence of these able student technicians would increase the efficiency of the service offered in the dental clinics. The experience would be of great value to the technician through broadening his outlook and increasing his understanding of the difficulties under which a dentist operates in the mouth, and it would be of equal value to the dental student in emphasizing the need for the fullest cooperation on his part if the best results are to be obtained. Whether or not this idea is practical can be ascertained only by making the experiment. I believe that the greatest difficulty would be met in inducing dental technicians to leave their benches for such a course, particularly if these men were selected, as Dr. Gies suggests, on the basis of unusual ability.

CONCLUSION

Let me restate that I do not believe that the question of offering courses for dental technicians in the dental schools is one that is likely to come up for our major consideration for a number of years to come. Until there is a demand for college-trained technicians on the part of dentists or the reputable highly departmentalized dental laboratories that are now serving the dental profession, no need for the establishment of such courses will exist. One of the joys of our calling as dental educators is the fact that we always have a sufficient number of major problems, either of pedagogy or administration, to keep us actively occupied. We have the question of determining finally during the next decade the length, character and contents of our course for undergraduate dental students.

It is desirable to put an end to the present state of complexification and to arrive at a reasonable degree of uniformity as soon as we can all agree on what is best for the dental profession in its relationship to the public and to the other professions. To attain this end, we must apply modern educational principles and take cognizance of the trends of the present day. In short, we must approach our problem with an open, receptive mind. Then too, we have the question of the nature of graduate instruction of dentists in our graduate departments and the relationship of these graduate departments to our courses for undergraduates. Short courses given by dental supply houses exist only because dental schools are not in general meeting the problem of graduate instruction. Furthermore, we have the obligation of training graduates who are capable of engaging in productive research for the purpose of discovering new methods and new truths. We also have the task of enlisting in our aid the proper financial support, so that we may realize our ambitions for dentistry. Lastly, we have the duty of spreading the spirit of prevention into the field of dentistry through our graduates.

These are the major problems that give us a compelling interest in life and are keeping us young, happy, enthusiastic and busily engaged. And it is a matter

of no little disappointment to me that I cannot end my remarks by bespeaking for the problem I have been invited to discuss the same attention and enthusiasm that I could if I had been considering one of these major projects. I may console myself with the thought that all great movements have many minor aspects and that all of these relatively unimportant details must be thoroughly considered and the problems relating to them solved and generally accepted before the effects of progress may become permanent and lasting.

A HISTOLOGIC STUDY OF REPAIR IN THE MAXILLARY BONES FOLLOWING SURGERY*

By WARREN R. SCHRAM, D.D.S., St. Paul, Minn.

SINCE most of the operations performed by the oral surgeon involve bone, a knowledge of the behavior of this tissue after surgery is fundamental in directing his technic. After the initial purpose of the operation has been accomplished, his aim must be directed toward the production of bone, the prevention of absorption or the control of new ossification. This work was done with the hope of obtaining definite information regarding the process of repair following surgical interference with the maxillary bones.

I have reviewed the literature on general bone regeneration and find that, from the time of Hippocrates, investigations and researches have been made into this most interesting subject. Practically all the work was done on long bones. The object of the various experiments made was to determine which of the cellular elements of bone, such as marrow, cancellous bone, compact bone or periosteum was most active in bone formation and whether any of them could be definitely excluded from the bone-forming process. Periosteum is the tissue which has claimed by far the greater share in these investigations. Duhammel, Dupuytren, Oiller, Axhausen and Phemister are among the outstanding investigators who have regarded periosteum as an active bone-forming agent.

In contrast to the opinions of these men, Macewen says that this tissue is a delimiting and protective membrane to the bone forming cells, but takes no active part in bone formation. Sir Arthur Keith sums up the varying opinions of these men by saying, "And here we are in the 20th century still with the same two sects, those who regard periosteum as the chief osteogenetic element of the human skeleton and those who regard bone itself as that element." Where is the truth? As in most cases of this kind, there is truth on both sides, but the greater share is on Macewen's.

In a recent work published by two French investigators, Leriche and Policard, we find conclusions in regard to the periosteum agreeing with those of Macewen, that it has no osteogenetic function. Our work deals primarily with regeneration taking place in the alveolar process after injury.

*From the Research Department, Northwestern University Dental School.

*Read before the Section on Oral Pathology at the Midwinter Clinic of the Chicago Dental Society, Jan. 14, 1929.

In reviewing the English literature, I find that no experimental studies based upon systematic histologic examination of these tissues following surgery has been recorded. Men writing on the subject have based their opinions on findings reported from long-bone experiments. cause of the demands of function. I refer to this controversy because of the direct effect which it has on the problem of regeneration in these tissues.

In the foreign literature, I find that Euler made a systematic histologic study of extraction wounds in dogs. Spitzer

Fig. 1.—Longitudinal buccolingual section of the socket eight days after forceps extraction.

H. W. MacMillan says, "Dental literature abounds with terms which describe the alveolar process as transitory and unlike true bone." He states that, in his opinion, this tissue is true bone, differing only from other bones of the body be- made a similar although less extensive investigation. Szabo, in a series of experiments, confirmed the work of these two men, and carried it farther by making a roentgen-ray study of extraction wounds in the mouths of patients.

In my experiments, I have hoped to carry the work still farther by making a comparative study of the osseous regeneration obtained in the maxillary bones of dogs after tooth removal by simple extraction and by the surgical method. A number of dogs with sound dentition were selected, and under ether anesthesia, an incision was made and the gum and periosteal tissue deflected, the buccal bone overlying the roots of the upper first bicuspid being exposed. The bone was smoothly cut away with a chisel, the tooth tipped from the socket and the tissue flap replaced and sutured. The same care in regard to technic and asepsis was used as would ordinarily be employed in the human mouth. As a control, corresponding teeth were removed by simple extraction. At varying intervals, the dogs were killed and the operative areas studied histologically.

Studying compositely Figures 1 and 2, it will be seen that, eight days after a forceps extraction, the socket is filled with an organizing blood clot, the surface of which is completely covered with epithelium. Organization has progressed most rapidly near the surface of the clot, and at the apex of the socket. Numerous newly formed blood vessels project into the substance of the clot. Extending from the bony walls of the socket and between them are columns of connective tissue that stain deeply with eosin and fuchsin. In the central part of the clot are many red cells in all stages of degeneration. Absorption is taking place along the entire alveolar wall. The haversian canals are widened and con-

Fig. 2.—Section of socket shown in Figure 1; one-half of the wound in a plane passing perpendicular to the one in which the section in Figure 1 was cut and near the orifice.

tain giant cells. There are numerous indentations where the original continuity of the alveolar bone has been destroyed between these areas on portions of the dense cortical bone which has lined the alveolar process. New bone is being laid down about strands of connective tissue.

Fourteen days after the removal of a tooth by forceps extraction, the changes already noted in the socket at the eighth day as characteristic are equally apparent. (Fig. 3.) Organization of the clot is slowest in the middle of the wound. The columns of connective tissue which project from the bone of the socket are distinctly calcified and converted into new spongy bone (cancellous bone). The entire alveolar wall is being rebuilt. Widened haversian canals and Howship's lacunae are in evidence along its entire extent, with resorption most active at the crest.

At twenty-one days, organization and calcification have progressed to where the body of the alveolus is practically filled with a cancellous new bone. (Fig. 4.) There are still remnants of the original clot in the center of the wound. The portion of bone extending above the area of cancellous regeneration is being quite rapidly cut away and resorbed.

Fig. 3.—Longitudinal buccolingual section of socket fourteen days after forceps extraction.

Forty-eight days after forceps extrac-

tion, the rebuilding of the alveolar bone is practically complete. (Fig. 5.) There is no evidence of resorption. New bone is being deposited here and there, and it may be assumed that a cortical plate will be laid down, eventually covering the area. In the older human specimens, this is nearly always present.

In Figure 6, a section is shown from a fourteen-day old wound following surgical removal of a tooth. There is a much more rapid organization of the blood clot. The entire wound is filled with a definitely organized connective tissue. There is no evidence that bone is being built from the periosteal side, but along the entire cut surface of bone, the rebuilding process is in progress. At the crest and lower buccal margins of the wound, active bone destruction is taking place. Figure 7, a section taken from the side of the same socket, shows a spicule of new bone which has grown out from the cut surface of the original process and which will eventually meet a similar outgrowth from the opposite side.

Forty-eight days after the surgical removal of a tooth, bone destruction has ceased, except at the crest. (Figs. 8-9.) Here, the bone is being very actively rounded down. There is evidence of bone being deposited around some of the spicules, and it may be assumed that the wound will eventually be covered with a cortical layer of bone. The spicules are not proliferating out into the tissue and

Fig. 4.—Longitudinal buccolingual section of socket twenty-one days after forceps extraction.

the outline of the bone is probably fixed by the connective tissue.

To better visualize and compare the osseous regeneration which may be expected to follow the two methods of tooth removal, a diagram may be helpful. (Fig. 10.) The heavy continuous lines represent the original outlines of the sockets following the two methods of extraction. The light dotted lines show the progress of bone regeneration and destruction at one week, two weeks, three weeks and seven weeks after forceps extraction. The light continuous lines show the bone rebuilding process at two weeks, three weeks, and seven weeks after surgical removal of the tooth. The heavy dotted lines show the approximate outline of the alveolar process when reconstruction is complete.

Fig. 5.—Longitudinal buccolingual section of socket forty-eight days after forceps extraction.

SUMMARY AND CONCLUSIONS

1. Forceps extraction wounds heal rapidly by the organization of the blood clot retained in the socket. In every instance, a satisfactory clot formed. At the end of eight days, the epithelial covering of the socket is complete. Cancellous bone is projected into the organized clot from the bottom and sides of the wound and first appears by the eighth day. In forty-eight days, the conversion of the organized clot into cancellous bone is complete, and the new bone projects above the resorbed margins of the old socket, without any material loss of either the buccal or the lingual plates.

2. Surgical extraction wounds heal somewhat more rapidly than forceps extraction wounds by the organization of a relatively small and limited clot of

Fig. 6.—Longitudinal buccolingual section of socket (center) fourteen days after surgical removal.

Fig. 7.—Longitudinal buccolingual section of socket (near one side), fourteen days after surgical removal.

Fig. 8.—Longitudinal buccolingual section through center of socket forty-eight days after surgical removal.

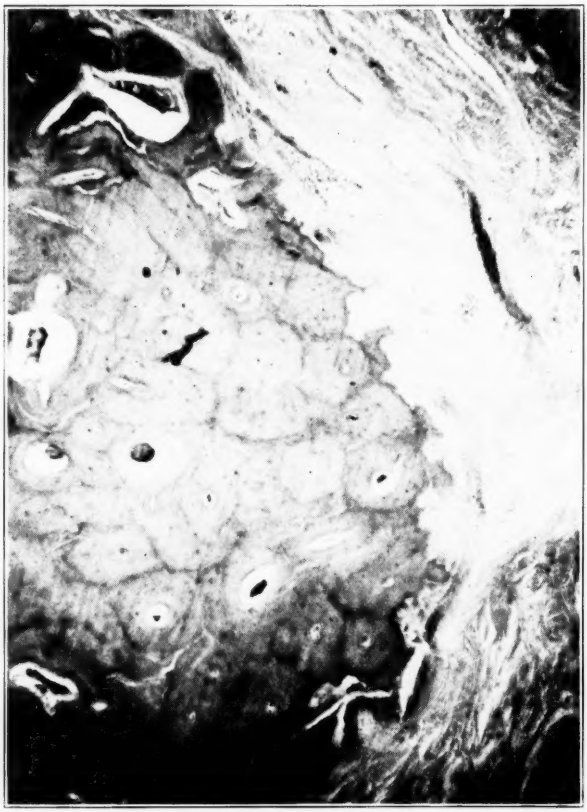

Fig. 9.—Higher magnification of alveolar crest of section shown in Figure 8.

blood. The speed of the organization of the soft tissues is particularly striking.

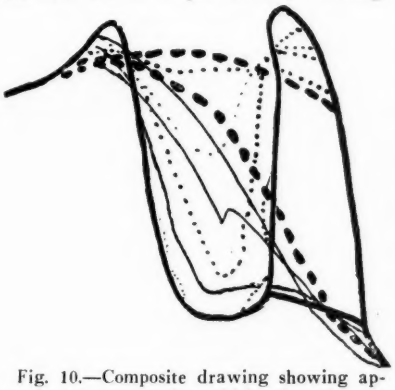

Fig. 10.—Composite drawing showing approximate regeneration which takes place in all the cases shown.

New bone appears at approximately eight days on the margins of the old bone, but nowhere else. A characteristic resorption of the crest of the lingual plate and of the angle of the lower margin of the wound is found. The new bone is more compact and is limited by the position of the mucoperiosteal flap, and although changes are taking place in the bone at the end of forty-eight days, the healing is practically complete. The form of the new ridge is typically different from that following the forceps extraction, and this is due to a loss of a certain amount of space at the crest and on the buccal aspect.

3. Bone apparently does not arise from the mucoperiosteal flap.

ORAL SURGERY CONDITIONS OF INTEREST TO THE GENERAL PRACTITIONER*

By EARLE H. THOMAS, M.D., D.D.S., LL.B., F.A.C.D., CHICAGO, ILL.

IN planning the presentation of this symposium on general oral surgery conditions, Dr. Miller and I have arranged that each shall present certain phases of the subject in order to avoid as much as possible any repetition or overlapping of subject matter. In covering such a broad subject in one evening, all references to each condition must necessarily be brief and to the point, and so only the high spots of that which is considered most important to the general practitioner will be mentioned.

FRENUM

When the fibrous tissue of the frenum of the upper lip extends between the central incisors and is attached to the lingual surface, it sometimes becomes necessary to perform an operation which will detach this fibrous tissue and replace it on the labial surface above the gingival border, where it belongs. Such an operation should be done subgingivally and should always preserve the free margin of the gum tissue around each central incisor instead of destroying the whole gum papilla.

IMPACTED UPPER CUSPIDS IN CHILDREN

It is rarely necessary to remove impacted upper cuspids in a child. Even if they are lying in the palate horizontally or at a greater angle from normal, room can be made for them and they can be brought down into normal position. This procedure can be facilitated by removing

*Read before the Chicago Dental Society, April 16, 1929.

*The papers of Drs. Thomas and Miller were presented as a symposium.

the soft and bony tissue over them, not only sufficiently to expose a portion of the crown but also to the extent of exposing practically all of the crown, and also removing all of the bony tissue in the path which the tooth must take in being moved to its normal position.

Packing gauze behind the exposed crown of the tooth will rapidly force the crown out sufficiently for the orthodontist to obtain an attachment without drilling a hole in the crown, as described by Frederick B. Noyes.

One must be sure, before attempting to operate, to localize the crown of the tooth accurately by roentgen-ray pictures, because some of these teeth must be exposed labially instead of lingually.

IMPACTED THIRD MOLARS

The first thing to consider in regard to supposedly impacted third molars is whether or not they are really impacted, and this can be determined only by competent interpretation of roentgen-ray pictures taken with a definite and correct technic. Normally erupting third molars may be shown in almost a horizontally impacted position on films made at an incorrect angle.

If the tooth is actually impacted, when should it be removed and when should it be left *in situ*? I should here like to express my adherence to the principle that all impacted or malposed teeth should either be brought into normal position or be removed. That is a principle, not an inflexible rule—you know we are supposed to use our brains once in a while.

Why should we be so radical, if such a principle may be called radical? To answer this question fully would require a paper in itself, but we cannot ignore the many serious conditions that can result from the presence of impacted teeth. Some of these are: neuralgias, which when once started, are not always relieved by the subsequent removal of the tooth; general nervous hypersensitiveness; mental symptoms, headaches, some types of insanity; reflex symptoms in other portions of body, eye, ear, stomach, etc.; local neuralgia; the crowding of other teeth out of alinement, necessitating orthodontic treatment or causing malocclusion with resulting generalized gingival disease; absorption or caries of roots of adjoining teeth, with their loss; development of large cysts around the crowns of these impacted teeth, resulting in loss of adjacent teeth and destruction of large areas of bone; after-exposure to saliva or to infection from the apex of a pulpless tooth, infection and its local effects, as well as its action as a focus producing infectious conditions elsewhere in the body.

And is it so radical to advise removal of impacted teeth at once when experience shows that it becomes absolutely necessary to remove practically all of them some time later, after damage has resulted? Even after jaws are edentulous and dentures are placed in the mouth, impacted teeth that have been left in will, most of them, cause trouble necessitating their removal. Now, if it becomes necessary to remove practically all of them some time in life, the logical thing is to remove them as soon as it is known that they are impacted and before they have caused trouble; prevention is the watchword. Furthermore, the earlier in life that they are removed, the less difficult the operation and the less the postoperative trouble. The removal of an impacted tooth in a young person with soft cancellous bone and with a good blood supply will often cause practically no postoperative reaction; whereas, in an older person, with dense sclerotic bone, the same operation may be very formidable.

If done in a competent manner, the removal of an impacted third molar is not the terrible operation that some dentists seem to think. Many are removed with practically no postoperative pain or swelling, and healing occurs as in an ordinary extraction. Furthermore, if the operation is properly done, there is absolutely no injury to the second molar.

Another thing: Some dentists look at the roentgen-ray film of a very difficult impaction and advise the removal of the second molar because, otherwise, they think it impossible to remove the third molar. Rarely indeed does the second molar need to be sacrificed for this reason, and such advice should not be given without consultation with the oral surgeon who is to perform the operation. It may be of interest to know that when both an impacted third and an infected second molar have to be removed at the same operation, most oral surgeons remove the impacted third molar first and the second molar afterwards.

If an impacted third molar has become exposed to the saliva, it is always infected deep under the gum and should most certainly be removed as soon as possible, not only to prevent systemic effects, but also to preserve the second molar in a healthy condition. Furthermore, a third molar that is fully erupted but which is crowded against the throat and cheek tissue next to the ramus of the mandible should, in most instances, be removed, because there is practically always infection under the gum tissue around such a tooth, and this is a frequent source of focal infection, not even second to alveolar abscess. Furthermore, these are frequent sites for the development of cancer in older patients, and no such source of chronic irritation should ever be allowed to remain in the mouth.

From the foregoing, you will understand why I disapprove of cutting away gum tissue flaps over erupting third molars. If the tooth is in such a position as to require this procedure, it usually should be removed.

OTHER IMPACTED AND MALPOSED TEETH

Many other teeth may become impacted or may erupt in an abnormal position. These should either be brought into proper position or be removed. Bringing them into proper position can be aided by methods similar to those described under "Impacted Upper Cuspids."

A dentist in referring a patient to an oral surgeon for the removal of an impacted tooth is remiss in his duties if he does not explain to the patient the nature of the operation—that it is not just pulling out a tooth.

ABSCESSED DECIDUOUS TEETH

When a deciduous tooth loses its pulp and becomes abscessed, let us consider the patient's health and life more important than the possible resulting malocclusion, and let us always advise removal of such a tooth. One glance at the statistics of heart disease in children ought to be sufficient to determine our decision in such cases, and all of this heart disease is caused by infection getting into the heart through the blood stream. Furthermore, when pulpless teeth in children become abscessed, the infection often has a tendency to burrow deep into the bone, causing serious cases of necrosis, resulting in facial deformity.

CYSTS

A cyst is lined with epithelium and any minute portion of its wall that is not removed will eventually develop into another cyst. This cystic wall is not scraped out by the haphazard curetting technic

often seen but is carefully peeled out in its entirety, the operator usually using the back of the blade of the curet. When such a cyst involves the inferior dental nerve or floor of the maxillary sinus, the cyst wall is carefully separated from these structures without injuring them. This will result in no extended anesthesia of the lip and no sinus infection. Also, when a cyst involves the side of the root of a vital tooth, such a tooth may usually be preserved. Teeth supposedly involved in a cyst are not extracted first and the cyst then opened into and removed. A cyst, according to a glance at the roentgen-ray film, may apparently involve several teeth but in reality be on the lingual side of them. Therefore, teeth are not removed until it can be seen from the inside which ones are actually involved.

Large chronic alveolar abscesses of extended duration often develop a cystic membrane supposedly from developmental epithelial débris, and in such cases a thorough curettement is necessary. Whether small alveolar abscesses with no epithelium present should be curetted is open to question. One important point to keep in mind is that curettement in the presence of any acute infection is most certainly contraindicated.

All diseased areas around the apices of teeth that are extracted without curettement should be checked with the roentgen ray a year later because occasionally such areas will heal over with retained infection. If so, it will be necessary to open into them and curet. However, not all bone in edentulous areas that appears darker than normal in the roentgen-ray film can be accused of indicating the presence of infection, as some men would have us believe.

Right here, I should like to mention that when a cyst is so extensive as to destroy both outer plates of the bone or when a "three weeks' course oral surgeon" removes gum tissue and periosteum in the performance of the operation for the removal of a tooth, fibrous tissue growing into the area from both surfaces will often prevent the redepositing of bone and a permanent black area in the roentgen-ray film will result, which will sometimes be mistaken for evidence of infection by one not familiar with roentgen-ray interpretation.

When an alveolar abscess on one tooth has destroyed the bone around an adjoining tooth with a live pulp, the latter can usually be preserved and a roentgen-ray checkup nine months later will usually show bone redeposited around its apex.

ACUTE ABSCESS

When an acute abscess first develops, and before there is any swelling of the soft tissues overlying the bone, the tooth may be extracted, even under local anesthesia. When the abscessed condition develops to the extent of involving the cheek or neck, local anesthesia should never be used. Injection into any acutely infected region can easily cause an uncontrollable extension of the infection, osteomyelitis with the loss of the jaw or, what happens more often than is realized, loss of the patient's life. When fluctuation demonstrates the presence of pus in the cheek, floor of the mouth or neck, the wisest procedure is to evacuate the pus by means of a suitable incision using nitrous oxid anesthesia, and to leave the extraction to a later period after all inflammation has disappeared. Such a condition should not be termed an ulceration of the tooth—it is far past that stage and is very serious. The incision should not be made into the middle of the most swollen part: it should be a generous incision in the place that allows the most direct access to the bone overlying the apex of the tooth causing the trouble,

because it is here that the pus will be found. Furthermore, an incision is usually useless unless the area is kept draining by some means such as gauze until all inflammation disappears.

OSTEOMYELITIS

In this serious condition, it is not necessary to bore holes into the cancellous structure or remove part of the outer plate as is done in the long bones of the body. The best procedure is to incise to and strip away the periosteum over the affected bone and keep it away by means of gauze packs. Neither should any loose teeth be extracted. This only complicates matters, and many of them can be retained in a healthy condition after the infection subsides.

SCLEROTIC BONE

Often in roentgen-ray films, we see areas of hardened sclerotic bone where we would expect normal cancellous bone. This usually occurs at a distance from the roots of the teeth, and nothing need be done because these areas are not infected. Such conditions also occur around the apices of teeth with vital pulps. There is another hardening condition of the bone with a slightly different structure which occurs around pulpless teeth and is an evidence of irritation. Such teeth are considered by some men to be a more serious source of focal infection than pulpless teeth with extensive apical bone destruction. Another type of sclerotic bone is sometimes found in the healing process after extensive bone operations. These are often a cause of neuralgia from the compression of small nerve fibers. This is relieved by stripping the overlying soft tissues from the bone, thus cutting off such nerves. Scar tissue in the soft tissues can also cause neuralgia from the same cause, and cutting away the scar tissue with close adaptation of the resulting wound margins is a treatment that often affords marked relief.

MAXILLARY SINUS

When the extraction of an upper tooth results in an opening into the sinus, it should be treated like an ordinary socket, the blood being allowed to clot, and the patient instructed not to blow the nose forcibly for a few days. The sinus should not be irrigated.

When a root is accidently pushed into the sinus, the usual method of choice is to enlarge the socket and try to recover it with instruments or by irrigation, but it may be necessary in some cases to remove it through the canine fossa. Such a root should never be left in the sinus to cause chronic sinus infection.

When an opening into a sinus stays open an undue length of time, it should be closed, usually by a flap from the palate.

Acute and chronic maxillary sinus infection should not be treated by the dentist unless he has had special training along these lines, and even then he should refer to the nose and throat specialist all cases of nasal origin.

BROKEN HYPODERMIC NEEDLES

Needles may be broken off in many locations, but I here refer to the most serious cases—those in which a needle has been broken off in the throat during a mandibular injection. Yes, it does happen, and more often than one might think. The following conditions may result in breaking of the needle:

1. Improper manipulation of the syringe—a delicate sense of touch must be employed in all injections.

2. Using the same steel needle too many times. Every time a steel needle is boiled, rusting occurs on the inside, which weakens it. Therefore, needles should be changed more often.

3. Inserting the needle with a quick jab, the point coming in contact with the bone and the needle thus bending sharply. We should always insert the needle slowly.

4. Sudden movement of the patient's head to one side. No mandibular injection should be made without the patient's jaw or head being held in such a way as to prevent any unexpected change in position.

5. Inserting the needle until the hub touches the tissue. As needles very often break at the hub, a needle should be used that is long enough to reach the desired location without the hub's touching the tissue.

6. Lack of knowledge of anatomy. Practically all needles that I have been called on to remove had been inserted half an inch or more past the correct site of injection. Therefore, we must learn the anatomy of the lingual surface of the ramus in order to be able to determine how to feel carefully with the point of the needle when it is in the right location.

7. Failure to caution the patient to keep the mouth wide open during injection.

SUBMAXILLARY GLAND INFECTIONS

These are often complicated by the presence of stones in the gland or ducts. A roengen-ray picture of the floor of the mouth should always be made in such cases.

GROWTHS

An epulis is an incipient sarcoma. It should be removed conservatively the first time; but if it recurs, all involved teeth should be extracted and the underlying surface bone removed. All I shall say of sarcoma and carcinoma is that the duty of the dentist is plainly manifest—he should examine the entire surface of every mouth to the end that every suspicious growth shall be recognized in its incipiency. Hypertrophied tissue due to the irritation of ill-fitting dentures should be removed, and this can be done with little postoperative discomfort to the patient.

VINCENT'S INFECTION

The presence of this infection, now commonly called trench mouth, contraindicates any surgical operation of any kind. The extraction of a tooth with such an infection present in the mouth may result in very serious consequences.

HEMORRHAGE

To control hemorrhage from a tooth socket, the patient is instructed to roll up a piece of cotton large enough to cover the top of the socket and hold it tightly in place with the finger or opposing teeth for five minutes, repeating this if necessary. This stops the bleeding long enough to allow the blood to form a strong clot. The socket is seldom packed, as this is undesirable and only to be used as a last resort.

THE ANESTHETIC

The administration of any anesthetic, either local or general, must be considered more seriously than is usually the case, and the decision as to the choice of the anesthetic should be left to the operator, who has been trained to recognize the safest and best procedure according to the physical condition of the patient and the type of operation to be performed.

REMOVAL OF TEETH

The removal of any tooth is a surgical operation, and the same surgical principles and responsibilities apply as to surgery of any other part of the body. To remove some teeth may be very simple, while to remove others may be a very formidable operation. Furthermore, the

teeth should be removed with the least possible injury to the adjacent tissues, and these tissues should be so taken care of that, when healed, they will afford a desirable foundation for dental resorations. To take care of this additional work sometimes takes many times longer and requires more skill than the extraction of the tooth.

The public by sad experience is realizing faster than certain dentists that the extraction of a tooth is a surgical operation, and they are demanding the results obtainable only by following correct surgical principles.

ROENTGEN-RAY INTERPRETATION

The importance of a complete roentgen-ray examination of all mouths must be stressed, and this must include all areas where teeth have been removed. Even when teeth appear perfect, it is surprising the conditions that will show up under roentgen-ray examination. In apparently healthy edentulous mouths, Boyd S. Gardner of the Mayo Clinic reports that about one-third show root tips, infection, etc. Furthermore, a complete roentgen-ray examination should show each tooth from at least two angles; and in doubtful conditions, the area should be roentgenographed from several angles.

I should like to emphasize the importance of learning how to interpret correctly roentgen-ray pictures of the jaws, and this must be done in conjunction with the history, a mouth examination and the use of a pulp tester. The best roentgenologist in this country or any other is not good enough to interpret from the film alone; consequently, all roentgen-ray laboratory diagnoses that are made from the films alone at the end of the day and mailed to the unsuspecting dentist are worse than worthless. Another thing: The roentgen ray never lies. When it is thus accused, the operator is reading into it something that "isn't" or missing something that "is." Of course, from the film alone, an operator can say that in such a location the film shows up darker than normal, etc., but that is not interpretation. Interpretation is the determination of the histologic anatomic or pathologic condition present in any given area and this requires more than a roentgen-ray film.

There are many normal dark areas showing up in roentgenograms, and these must not be confused with evidence of pathologic change. Also, some dark areas are abnormal but are not pathologic. One other thing must be stressed: Many films have inherent imperfections which may simulate various abnormal conditions and may lead to unnecessary operations.

Along the line of aids to diagnosis, I want to point out that the extensively advertised mouth lamps do not, as their sponsors would have us believe, "immediately determine and diagnose practically every debatable condition that presents itself in routine dental practice." A diagnosis of root-end infections determined in this manner does not check roentgenographically—but some of these lamps do give good light.

DENTISTRY AND HEALTH

Even though dentistry is progressing by leaps and bounds, we still have a few dentists who have not yet awakened to the fact that they are working on a patient; they might as well be doing mechanical work on teeth out of the mouth as far as considering the teeth a part of the human body is concerned. We find such men giving a mouth consultation for a physician without even getting a roentgenogram, and we also find them putting expensive bridges and other restorative work on badly abscessed teeth. Such work instead of being bene-

ficial to the patient is a direct menace to health and life.

There has been a movement started to create a new profession, not included in or identical with either conventional dentistry or medicine, namely, stomatology, and it seems to be gaining some headway. Why? Possibly for the same basic reason that prompted Surgeon-General Cumming of the U. S. Public Health Service, in emphasizing the relationship of dentistry to general medicine, to say that "although the dental profession has not been entirely neglectful of its public health duties, there is yet urgent need for a broader public health viewpoint than most dentists have so far assumed." He also stressed the point that dentistry must recognize to a greater degree and equally assume its public health responsibilities, and that unless it does so, an oral specialty in medicine will inevitably be organized.

ORAL SURGERY CONDITIONS OF INTEREST TO THE GENERAL PRACTITIONER*

By HOWARD C. MILLER, D.D.S., Chicago, Ill.

IN the preparation of this symposium pertaining to oral surgery conditions of interest to the general practitioner, an attempt has been made to confine all remarks to the practical phases of the various conditions that are met with, and necessarily must be cared for, in the general practice of dentistry. With this the object of the presentation, each paper has been so prepared as to prevent, as far as possible, any overlapping of material, in order that the many problems which arise in this important branch of general practice may be considered.

Dr. Thomas has presented many important phases of the subject and has given valuable information as to the diagnosis and treatment of pathologic conditions within the mouth. In order that the object of this part of the symposium may be fulfilled, and the phases assigned considered in their proper sequence, it will be necessary to begin with the patient on presentation for treatment.

Dr. Thomas has emphasized the importance of a complete set of oral roentgenograms, not only of the remaining teeth but of the edentulous areas as well, before any attempt at a diagnosis or treatment shall be made. He has stressed the importance of correct roentgenographic interpretation and the dangers of misinterpretation, all of which must be considered seriously. To diagnose a case is to determine scientifically the distinctive nature of a disease or ailment by its symptoms, and to discriminate as to whether or not the condition is that of health or disease; all of which is imperative before proper treatment can be instituted, as proper diagnosis is the basis of all treatment.

A true oral diagnosis can be made only by the correlation and consideration of the past history, history of the present disability, clinical findings, roentgeno-

*Read before the Chicago Dental Society, April 16, 1929.

graphic findings, not only of the remaining teeth but of all edentulous areas as well, vitality tests and any other diagnostic means that may aid in obtaining a knowledge of the conditions presented.

Often cooperation with the physician is imperative in order that his opinion and interpretation of general conditions, laboratory reports, etc., may be combined with that of the dentist, and by a thorough consideration of all factors, the patient will receive the greatest benefit.

In the building of full dentures, to the many records such as various facial measurements, length and alinement of the teeth and other data recognized as essential should be added a complete set of oral roentgenograms, inspection of which will disclose remaining root particles, unerupted teeth, areas of residual infection, cysts, sharp bony projections and remaining particles of filling material that may have become lodged within the tissues, which may interfere with the comfortable wearing of the dentures and may become a source of trouble later on.

Since the discovery of the roentgen ray, advancement has been rapid in this field. However, this should not be employed to the exclusion of the older methods such as inspection, palpation, percussion, response to thermal change, history and the interpretation of the various subjective symptoms of pain.

Many dentists depend on others to make their roentgenograms, feeling that those who have made a study of all technical phases of the work are better able to produce them, and therefore refer their patients for service of this type. It must be remembered that the price charged for the making of these films is a technical fee for producing them and that, in the majority of cases, these pictures are of no value without a correlation of all factors. The roentgenograms are sent to the referring dentist, and after he has examined them, with due consideration of all other factors, and has given an intelligent report of conditions and suggested possible treatment, he is entitled in every case to a fair fee for this service, whether or not the patient is to have the work done. This is true of all like services given by the physician, lawyer or any professional man whose advice is sought, and when the dental profession as a whole accepts this practice, the opinions and consultations given every day to thousands of patients will be looked on with more respect.

If dentists will interpret oral films in the same manner that the physician interprets roentgenograms of other parts of the body, i. e., in conjunction with all clinical signs and symptoms, not only will the patient be unmeasurably benefited, but there will also be fewer errors in the treatment of oral conditions.

The selection of the anesthetic to be employed in any case is most important. It rests with the individual operator and is determined on the basis of the physical condition and temperament of the patient, the type of operation and the personal choice of the one making the selection. No single anesthetic is best adapted for all cases, but there are operators who have a decided preference for one and who are inclined to condemn the use of any other not only in their own practice but also in the hands of others. This is an injustice: the successful operator selects the anesthetic best adapted to the case, the one by which the patient will receive the greatest benefit.

It is the custom of some general practitioners to send a patient to an exodontist with explicit orders to remove certain teeth under a specified anesthetic, a procedure which results in difficulty for the

exodontist if his choice should differ from that of the general practitioner. This practice should be thoroughly discouraged as unscientific and unjust to the specialist, as he alone knows best how he can perform a certain operation to secure the best result.

In a presentation of this type, time will not permit a consideration of the various general anesthetics which hold so valuable a place in the field of dentistry, the use of which necessitates extensive study and preparation before entering this important specialty of surgery.

Local anesthesia in its various forms has successfully passed through the experimental stages and has reached its rightful place among accepted dental procedures. Though extensively used with almost complete safety and success, the responsibilities even in a procedure so apparently simple are just as great as in the use of general anesthesia and should never be minimized.

Many think of local anesthesia as a method of injecting the anesthetic solution into the surrounding tissues under pressure; this having come to us from its early use when pressure was considered essential to success. There can be no doubt that this is the cause of many tissue lesions and much discomfort to the patient, in that it produces considerably more primary pain and a markedly increasing secondary cellular reaction.

Clinical experience has proved that if a solution is injected slowly and with pressure sufficient only for it to be discharged into the soft tissues along the mucobuccal fold, or into the deep tissues near the entrance or exit of the nerve trunk from its bony canal, it will prevent many of the unfavorable sequelae occurring when the solution is infiltrated into the dense surrounding gum tissue.

It is not uncommon to hear comparison of the so-called infiltration and the deep block methods, when in reality anesthesia is produced in both by the solution infiltrating the nerve structure. In one, the solution is injected into or around the operative field; and in the other, at some point distant from the field of operation. Never in blocking branches of the fifth cranial nerve is an attempt made to pierce the nerve sheath. This, many times, is one of the causes of technical failure, in that the solution is not sufficiently near the nerve trunk for it to infiltrate the surrounding tissues and epineurium and to anesthetize the central nerve fibers completely.

There are those who object to the use of local anesthetics, asserting that they interfere with the circulation and have a great deal to do with many of the violent reactions and exacerbations that are seen following the removal of teeth; also that unnecessary pain and swelling are produced by their use, and that the blood clot in the socket more often breaks down and disintegrates after two or three days.

Postoperative pain varies in different individuals and is governed by the physical condition of the patient, the amount of infection present, the amount of surgical trauma necessary to eliminate the pathologic areas and the use, to a certain extent, of the local anesthetic, when one is employed.

The amount of postoperative pain that is due to the use of a local anesthetic is governed to a great extent by the solution injected and the manner of injection. The solution should be properly prepared and should contain the smallest amount of the vasoconstricting agent (epinephrin) necessary; and it should be injected slowly, with only sufficient pressure to discharge it, and should be near body temperature. Each of these

factors serve to determine the amount of postoperative pain. In all cases, there is a period of absorption after the action of the vasoconstricting agent has passed away, owing to the dilatation of the vessels and an increase in blood supply to the part, the result of the compensatory action of the epinephrin, which always manifests itself in a hyperemia of the part following its use. This period of absorption lasts from two to five hours, during which time the injected solution is completely absorbed, provided absorption corresponds as nearly as possible to the physiologic action of the living tissue cells. While absorption is taking place, the patient may experience some discomfort and soreness due to the use of the local anesthetic, but if they have been sufficiently warned of this, and proper directions are given to combat it, they are quite likely to minimize the amount of discomfort and in many cases will report that no pain was experienced.

The principal reason for surgical interference in the mouth is the presence of pathologic conditions; and in order to eliminate these conditions, it is necessary to produce a certain amount of trauma to the tissues, which is unavoidable, and which in itself produces postoperative discomfort, the amount depending on the severity of the operation.

Among the causes of swelling is the rupturing of a small blood vessel by the insertion of the needle, which allows its contents to escape into the surrounding tissues. Another cause is too rapid injection, which may produce ballooning or distention of the tissues. The use of dull needles and careless manipulation of the syringe may also traumatize the tissues unnecessarily and produce excessive swelling. Another cause is undue trauma in the removal of the teeth, especially in difficult cases, as many operators are satisfied if they successfully remove the tooth, regardless of tissue injury. The spreading of infection either by injection through an infected area or by the improper handling of infected cases and other factors are also contributing causes which some operators are prone to blame on the use of a local anesthetic.

The question of disintegration of the blood clot or the production of the so-called dry-socket is a difficult one. This condition may occur when a general anesthetic has been employed instead of a local. In order to decrease the possibility of its occurrence, the operator should strive to prevent the entrance of saliva into the socket or wound. After operation, the patient should not be allowed to rinse the mouth vigorously, but should be requested to bite on a small pack of gauze placed over the wound for approximately ten minutes, which permits coagulation to take place at the base of the socket without disturbance. The patient should be dismissed with instructions not to rinse the mouth vigorously for twelve hours, a procedure which is particularly applicable to the lower jaw, where this complication is most prone to occur.

When the so-called dry socket does occur, no great amount of good results from attempting to stimulate a fresh flow of blood by surgical means. The principal treatment should consist of keeping the patient comfortable until Nature has created a natural covering for the exposed bone and nerve endings. This is best accomplished by cleaning out the disintegrated blood clot, by washing and sponging the tooth socket. The mouth is then packed with gauze to prevent the entrance of saliva into the socket, to which an antiseptic solution is applied, the excess being taken up on a

sponge. A small piece of iodoform gauze, only sufficient to fill the cavity loosely, is then saturated with an oily sedative dressing and inserted into the socket and allowed to remain for from twenty-four to forty-eight hours, when the treatment is repeated, being continued until the pain has completely subsided. In some of the milder cases, any of the various surgical dressings may be employed to protect the socket during this period instead of the gauze and oily sedative dressing.

Strict adherence to asepsis is of course essential throughout the operation and afterward. There are many who give too little attention to the proper care and sterilization of syringes and needles before and during their use, are careless in the preparation of the solution and give no particular thought to the conditions under which the operation is performed.

One of the most common of the superficial infections met with is acute Vincent's infection, and the danger of surgical interference in these cases is great, it many times causing widespread and serious infection. The condition should be treated and controlled before any operative procedure is resorted to.

Any form of acute ulcerative gingivitis or severe infection about unerupted or impacted third molars should be carefully treated and brought under control before operation is attempted, as the danger of spreading the infection, particularly in this region, is great. It is not always necessary to eliminate the infection completely before removal of the tooth; but after a few treatments, the tissues will be better able to protect themselves against the invasion of bacteria which may result from the trauma produced by the operation.

In dealing with the acute type of dental infection, such as alveolar abscess, great care must be exercised in the use of a local anesthetic, as even in the early stages the extent of tissue involvement and the virulence of the organism is an unknown factor.

Treatment of these infections should be the same as in any infection elsewhere in the body, such as the controlling and regulating of the inflammatory process, with a diffusion of the infection wherever possible, and sufficient drainage when necessary. In an acute alveolar abscess, this may be accomplished through the tooth socket by removal of the tooth, if the area has not extended to involve the periosteum and surrounding tissues. In such cases, more adequate drainage is necessary and should be instituted and maintained for a sufficient time to enable the resisting forces to combat the infection and restore the tissues to a normal condition.

The fundamental basis of local anesthetics is a thorough knowledge of the anatomy of the parts involved, followed by the next important step, which is essential to success; i. e., a definite technic.

The successful use of a local anesthetic involves the careful application of its fundamental principles in every case in which it is employed, and as its basis, diagnosis, scrupulous asepsis, proper anesthetic solutions, a knowledge of anatomy and an exact technic are essential.

The responsibilities assumed in accepting a case for removal of teeth are greater than they were believed to be in the past, as it is only within the past few years that any particular thought has been given to the possible relationship between infected teeth and subsequent remote disease of the body, and formerly the service consisted simply in relieving the patient as best we knew how.

The first and important duty of the operator is the removal of the teeth with the least amount of trauma necessary, the removal of all root tips and the complete eradication of all pathologic areas resulting from the offending teeth. The second is that, in dealing with the foundation of the dentures which the patient is to wear for many years to come, he must keep in mind the future restoration, and work along definite lines in order that this foundation may be the best possible, considering the pathologic condition present.

It is a fact well established by recognized leaders in the prosthetic field that, in the removal of all teeth, an operative technic should be employed which will facilitate the early insertion of dentures upon a base free from the rough jagged edges of bone that are left for Nature to smooth after a simple extraction.

The operative procedure necessary in a given case is governed by (1) the amount of pathologic destruction present, as revealed by a complete roentgen-ray examination not only of the remaining teeth but of all edentulous areas as well; (2) the future esthetics of the case, that is, as to whether or not the reduction of the anterior portion will be necessary for the proper setting of artificial teeth and the restoration of the mouth and facial contour; (3) the physical aspects, such as large bony protuberances, excessively heavy alveolar crests or large bulky tuberosities; (4) the ridge relation, or the relation of the upper and lower ridges to each other, which, in many cases that are abnormal, may be corrected, thus greatly assisting the one who is to build the restoration. These conditions govern the amount of surgical interference necessary in a given case.

It is the belief of many that this procedure requires the sacrifice of a large amount of osseous structure, whether it be a single extraction or a complete case. This is far from being true; nor is it in keeping with the final result of a more conservative procedure. Many times, all that is necessary after extraction is the use of small rongeur forceps and bone files to bite and smooth the rough sharp edges of the process which remain after a simple extraction. This may be done in many cases where one or more teeth have been removed, by retracting the mucoperiosteum sufficiently to allow the smoothing and removal of rough jagged bone, making it unnecessary to reflect a large buccal flap in order to gain access.

It is obviously impossible to lay down ironclad rules to be followed in every case, but the importance of a definite and thorough technic which can be followed as a basis of operation should be emphasized. Surgical interference is not indicated in every case after the removal of teeth, and when it is necessary, should only follow a common sense conservative technic, based upon a careful study of the operative results, both by roentgen ray and by direct examination, and by close cooperation with the one making the restoration.

Responsibility to the patient is not fulfilled by the removal of the teeth and the elimination of pathologic areas, as postoperative care is of equal and many times of greater importance than the operation. All cases should be seen after operation and should be kept under observation, with any necessary treatment. until such time as they may be dismissed with complete certainty of no further complications. Many cases of acute osteomyelitis develop after the extraction of teeth with acute symptoms of swelling, pain and pus, in which free and open drainage was not established and main-

tained for a sufficient time. Some cases develop when teeth have been extracted and other adjacent teeth with pericemental and periapical bone areas are left, the operation thus traumatizing an infected area and leaving it without treatment. As osteomyelitis will occasionally develop or appear after the removal of a painful tooth, it is not always possible to predict the outcome of what appears to be a very simple extraction.

Probably there is no other condition in the field of surgery in which greater care and a more cautious procedure must be followed than in acute or chronic osteomyelitis. The tendency to operate radically and employ active curettage to eliminate the infection should be absolutely avoided on its discovery. The patient should be kept comfortable by the use of sedatives and either hot or cold applications, while waiting for the infection to localize and the sequestra to form. After it is evident that drainage can be established, an opening should be made and maintained, with the removal of the sequestra as they are found by a limited and gentle exploration, no attempt at vigorous and extensive curettement being made. If teeth are removed in osteomyelitis, large free openings should be made into the bone and the area loosely packed with iodoform gauze, which should be changed frequently—at least once or twice a day—the wound being thoroughly irrigated. In extensive cases of the mandible, an incision should be made under the inferior border of the jaw, and should be kept open by a drain tube to allow free drainage. Therefore it is important that the symptoms of osteomyelitis be recognized and the proper treatment instituted. The latter should be based upon slow and watchful waiting, many times extending over several months, with thorough drainage and careful surgery.

The general practitioner is oftentimes called on to treat cases of fracture of the jaw in which a thorough knowledge of the anatomy of the parts, the muscular forces involved and the complications that may arise are essential.

It is impossible in a presentation of this type to consider the treatment of various types of fracture. The best results are obtained in the early reduction, and if no other treatment is practicable, owing to excessive swelling or lack of proper mechanical appliances for the time being, the parts should be supported by a figure-eight bandage until such time as the operative procedure can be carried out.

Interdental ligation by the use of properly placed wires of the type used in the practice of orthodontia will prove very satisfactory provided teeth are present in the proper relation to establish normal occlusion and overcome the various muscular forces that must be given so much consideration. The use of bracket bands and a ribbon arch has proved very satisfactory when they are properly placed and adjusted. It is usually accomplished in cooperation with an orthodontist, who is more familiar with the placing and adjusting of such an appliance. As many teeth as possible are banded with the bracket bands, these being cemented in place before reduction of the fracture. After reduction, the ribbon arch is slipped into place and fastened and adjusted to overcome muscular forces. This type of appliance allows free use of the jaw and proves very satisfactory when properly adjusted.

Edentulous cases require the building of splints or the use of direct wiring and are much more difficult to handle.

Postoperative care after the removal

of teeth has been stressed throughout this presentation, and it must be emphasized that it is as important as the operative procedure itself in many cases. No matter how skilfully the operation has been carried out, proper instruction to the patient as to home care, the return for irrigation and, in some cases, dressings and the careful watching of all cases in order to prevent complications and to keep the patient comfortable are imperative.

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TWO PERIODONTAL CASES*

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WHEN requested to report two periodontal cases, I asked two patients whose teeth I treated several years ago to have new roentgenograms made, the object being to select two very different types of periodontal destruction, one a chronic pericemental abscess, the other a typical periodontal lesion which had advanced to what seemed to be a hopeless stage. The roentgenograms, which reveal extensive changes in the bone, illustrate several important points.

The pericemental abscess, shown in Figure 1, occurred in the mouth of a patient about 30 years of age, who came to me for treatment in 1919. At that time, there was a chronic gingivitis around all of the teeth, with several deep pockets in addition to the pericemental abscess. The problem before me was to cure this chronic abscess permanently without causing any recession of the gums. The physical condition of the patient made such a result seem very improbable, as she was extremely nervous and decidedly anemic. The irregularity of the teeth was also an unfavorable factor.

A careful study of the original roentgenograms reveals the fact that the abscess completely encircled the right central incisor root some distance beneath the gingival margin of the gum and extended almost to the apical foramen on the distal side. It also involved a large portion of the lateral root. Some of the poorly calcified bone which can be seen in these roentgenograms was located some distance to the lingual side of the roots and was merely superimposed on the diseased area in the roentgenograms. Exploration with an instrument revealed the fact that the only connection between the abscess and the gingival sulcus was a narrow channel on the mesial side of the central incisor root. Apparently, it was the blocking of this narrow channel that caused the extensive involvement at the upper end. The fistula was on the labial side of the gum, midway between the lateral and central roots, and considerable hard calculus had formed on the involved cementum.

The surgical technic employed in the treatment of these cases will be understood more clearly if we consider some

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important facts regarding the tissues. In the first place, it should be remembered that cementum receives nutriment from both the pericementum and the pulp and does not necessarily die when the pericementum becomes separated from it, as long as the pulp remains vital. Therefore, the separated tissues can form a vital reattachment when the involved surface of the cementum is surgically freshened. We must bear in mind that the gingival third of the cementum is very thin, frequently not thicker than paper; and when it is removed, the soft tissues do not reunite, unless new cementum is formed over the dentin. It is not unusual to find new cementum formed over the dentin in cases in which absorption has removed the original cementum from some portion of a root and burrowed deeply into the dentin, but these cases must not be confused with gingival exposure of the dentin. The area of typical root absorption is surrounded on all sides by pericementum which is attached to normal cementum, while the area exposed gingivally is directly connected on the one side with the gingival sulcus. This open side permits the entrance of mouth débris, and the invasion of pyogenic organisms. The rebuilding of cementum over the dentin, under these conditions, is far less probable. Although the reunion to the cementum is possible, we should always leave a very small wound, with the soft tissues as close to the root as possible, that there may be a small amount of repair required. It is not necessary, as the present cases illustrate, to remove all of the granular tissue. When it is thoroughly removed, the space which remains around the root is so large that it can be filled in only by a slow process of repair.

While this slow process of repair is going on, the surgically freshened surface of the cementum becomes coated with débris, and this film holds the tissues apart and prevents reunion. The epithelial lining of the chronic periodontal pocket must not be overlooked. If escharotic agents are employed to remove the epithelium, they should be used several days before the surgical treatment, and never after it is completed. It is better procedure to freshen the healed inner surface of the pocket slightly with the surgical instruments, but this should be done with great care and gentleness. The surrounding soft tissues must be left as nearly free from laceration as possible, and in very close apposition to the root. If the retention of the gingival tissues at the point where we find them were not extremely important, it would be an easy matter to cure these lesions

Fig. 1.—Loss of bone which resulted from a chronic pericemental abscess (roentgenogram made in 1919).

Fig. 2.—Case shown in Figure 1, after nine years (1928). New bone has developed in the abscessed area after surgical treatment.

by the ruthless removal of all of the affected tissues; but that is not periodontia. The only cases which stand the test of time are the ones in which healing takes place rapidly.

In commencing the operation for the pericemental abscess, it was found that most of the surgical work could be accomplished more easily and thoroughly through the fistula. The first act, therefore, was to increase the size of the fistula by making a vertical incision about 6 mm. in length, which did not extend

Fig. 3.—Above: Loss of bone from a pericemental abscess (roentgenogram made in 1925). Below: Case after three years (1928). There has been considerable rebuilding of bone as the result of surgical treatment.

to the margin of the gum. Keeping the margin of the gum united served two important purposes: It held the margins of the incised tissues in close apposition so that they could reunite rapidly. It also prevented the unsightly notch in the margin of the gum which would have resulted from severing it.

The granulomatous tissue was not removed, but the calculus was thoroughly removed and all of the involved cementum very carefully curetted, special care being exercised not to sever the tissues at the foramen of the central root or to expose any of the dentin. Some of the surgical work was accomplished through the narrow opening which connected the abscess with the gingival sulcus, but the

Fig. 4.—Extensive destruction of the root as well as the supporting structures resulting from a chronic periodontal infection (roentgenogram made in 1925).

Fig. 5.—Case shown in Figure 4, after three years (1928).

width of this opening was not increased to any appreciable extent.

The wound was not washed out during the operation or at any time during the healing process. If we should attempt to wash out the loosened particles of calculus in these cases, the close apposition of the soft tissues to the root would make it difficult. Therefore, these

particles were removed from the wound by the instruments as they became incorporated in the fibrin of the liberated blood. Although there is very little hemorrhage when the operation is performed in this careful manner, even this small amount assists in the mechanical cleansing. When the surgical work was completed, and the wound cleansed in this manner, the next step was to start a little fresh hemorrhage, as the presence of a blood clot in the wound plays an important part in the healing. No medicinal agents were employed, full reliance being placed on the bactericidal properties of the tissues to destroy the remnant of bacteria which the surgical work would leave in the wound.

By an observance of these biologic principles, the wound healed so rapidly that, by the next day, the patient experienced no discomfort, and the only care the wound has received during the nine years which have followed has been ordinary prophylaxis. There has not been the slightest recession of the gums around these teeth as the result of the operation and the tissues now have an unusually healthy appearance. The recent roentgenograms, as seen in Figure 2, show that the granuloma has been replaced by new bone of a very good quality.

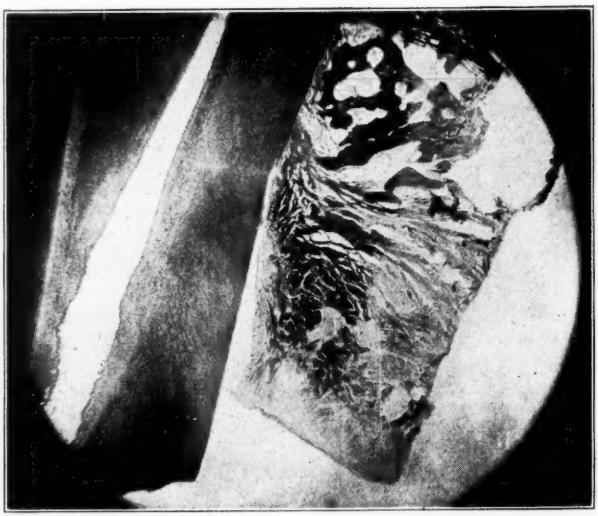

Fig. 6.—Results of both correct and incorrect surgery. It can be seen that considerable cementum had been removed from the root by the instruments. The soft tissues formed a very perfect reunion with the cementum, but did not reunite to the denuded dentin. A small amount of new bone can be seen in this photomicrograph.

Before I describe the second case, it will be helpful to present roentgenograms, as seen in Figure 3, made (above) before and (below) after treatment of a pericemental abscess on the distal side of an upper left cuspid root which was operated on in a slightly different manner. As in the first case, most of the surgical work was done through the fistulous

opening on the labial side, but the narrow channel which connected the abscess with the gingival sulcus was widened more extensively. This may account for the wider space which remains between the root and the lower portion of the new bone. In spite of this, the new bone has a strong, healthy appearance, and the gum at that point appears quite normal.

The second case, shown in Figures 4 and 5 was an ordinary periodontal lesion which had advanced to what seemed to be a hopeless stage, and was operated on only as an experiment. The patient, a woman, aged about 50, was sent to me for treatment by an orthodontist in 1925. At that time, the entire mouth was badly infected and the upper right central incisor could be retained only by the use of a mechanical appliance. The roentgenograms show that the granular tissue had very nearly encircled the root and extended some distance beyond the apex. In addition to this, the apex of the root was so badly absorbed that the original foramen was entirely destroyed. The pulp had remained vital.

It can readily be seen that the granuloma could not have been entirely removed in this case without severing the tissues at the apex of the root and causing death of the pulp. This would have removed the only remaining source of nutriment from the denuded cementum and prevented the soft tissues from reuniting.

No anesthetic was employed for the operation. We should always operate so accurately and gently in these cases that the use of an anesthetic will be unnecessary. The patient can then cooperate with the surgeon and let him know instantly if the instrument touches the dentin. The fact that the tissues were normal in this case led to the discovery of a condition which was far more unfavorable than the absorption of the apex of the root: the cementum had been removed from the mesial side to within about 2 mm. of the absorbed apex. This took away all hope of a rapid or perfect reunion. This could be brought about only by gradual formation of new cementum over the dentin from the edges. The exposed sensitive dentin was cleaned very gently with the instruments and all of the surrounding involved cementum lightly curetted. No sealing agent was employed to protect the blood clot. When these agents are employed, they must of necessity penetrate into the wound and interfere with the reunion. The tooth was then left strictly alone for about two weeks to let healing advance far enough to permit of polishing. The retention of the tooth remained in the hands of the orthodontist and proved very unsatisfactory. His retaining device permitted the tooth to sag below its original position, as can be seen by comparing the old and the new roentgenograms.

Although the results in this case are not all that could be desired, at least two things have been demonstrated. First, the granuloma was replaced by new bone, and, secondly, the absorption of the apex of the root was not a serious hindrance. The bone is also greatly improved around the adjacent teeth.

From the patient's side of the case, the results are very gratifying. The tooth is firmer than the roentgenograms indicate, requiring no artificial support, and the gums, which are almost normal in form, have a very healthy appearance. If this tooth should be lost later on, it will be due to the large surface of denuded dentin on the mesial side of the root and not to the absorbed apex.

The removal of the cementum brings about such an unfavorable condition that we should not pass this phase of the subject without further study. Figure 6, a photomicrograph of a case of this kind, lent by the dental research department of the University of California, will help us to understand how very serious such a condition really is.

The records of this case show that the depth of the pocket had been reduced 3 mm. by surgical treatment, but all attempts to bring about a further reduction in the depth of the pocket had met with failure. The tooth with some of the surrounding structures was then removed and examined microscopically. The photomicrograph of these structures shows why the failure occurred: the cementum had been removed from the portion of the root where the tissues had failed to reunite. It can also be seen that the reattachment of the tissues was complete where the cementum was left intact. A small piece of cementum can be seen a short distance from where the normal cementum abruptly ends. This may be new cementum which had commenced to form, but it is more probable that it is a fragment of the original cementum which the instruments had not removed.

While the cementum is very thin on the gingival third of the root, it looks so thick when magnified, even to the small degree the present photomicrograph shows, that one might think the removal of it was due to carelessness, but this may not have been the case. The deposits are frequently so hard, and so firmly attached to the porous surface of the cementum, that it is extremely difficult to remove the last trace of them without also removing the cementum. It is advisable, therefore, for those who wish to practice this branch of surgery to do their experimental work on the roots of teeth that are to be extracted before attempting to operate on teeth that are to be saved.

The results in these cases disprove several old theories regarding the tissues, and emphasize the importance of the clinical side of our research work.

Since the separated tissues become reattached to the cementum of vital teeth when aided by proper surgery, we should not resort to the destructive method of cutting off the gums. We are not periodontists in any sense of the word, unless we preserve these structures.

In comparing the photomicrograph with the roentgenograms of these treated cases, it should be remembered that the photomicrograph shows the soft tissues as well as the bone, while the roentgenograms show only the bone, making the results seem far less favorable than they actually are.

PREDETERMINATION OF STRUCTURAL CHANGES IN EDENTULOUS CASES*

By HOWARD H. JACKSON, D.D.S., Detroit, Mich.

PREDETERMINATION of structural changes in edentulous cases depends on the examination of roentgenograms of the cortical layers and cancellous structures in the areas which are to support tissue-borne pieces. From this examination we are able to foretell to what degree these tissues are to be considered as favorable for such use.

The problem of securing gratifying results with tissue-borne pieces—whether full dentures or other types—lies not only in the proper application of the mechanical principles involved in that particular case, but also in having a stable ridge upon which the piece is to rest. Cases in which the mechanical problems have been correctly solved, i. e., in which balance has been obtained, have many times proved unsatisfactory because of loss of tissue adaptation, and it is these cases which have pointed out that the character of the supporting structures is a definite factor to be considered in the construction of tissue-borne pieces.

Roentgenographic examination of the supporting structures in cases in which balanced tissue-borne pieces have been unsatisfactory reveal conditions which are not usually noted in favorable instances. Are these changes indicative of (*a*) conditions arising after the pieces have been seated; or (*b*) do these changes occur between the time of extraction of the teeth and the construction of the piece; or (*c*) were they present before the extraction of the teeth, and, if so, (*d*) should they not have been recognized, might they not have been amenable to treatment, in some instances at least, so that a more favorable type of ridge form might have been produced? We believe that we have a working basis at least for studying these changes and that classification of them is possible so that the prognosis of any given case may be stated within reasonable limits of accuracy.

Hugh W. MacMillan has presented a beautiful study of the desired type of supporting structure of a partially edentulous mandible. In it, he showed beyond question that it is Nature's intent to so lay down the cortical layers and cancellous structures that sufficient resistance will be present to withstand mechanically the strains and stresses to which they may be subjected. The registration of the desired type of tooth-bearing case will show a distinct crest of the septum, formed as it is by the union of the cortical layers with the walls of the socket, and a uniform density of the cancellous structures throughout the septums and body of the bone which is characteristic of that individual. In some persons, there is a marked deviation in the average of the density observed. Unfortunately, not all individuals show these

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favorable registrations. There are influences which can alter or modify Nature's design or intent, and these produce changes which eventually interfere with successful denture construction.

From the desired type of registration in the dentulous case, we note three rather definite and distinct kinds of recession. (Remember that we are dealing with roentgenographic registrations and are not speaking in terms of clinical or visual changes.)

The first, or uniform, type of recession is characterized by a generalized recession of the septums. The crests may or may not register a distinct durocortical junction, but the cancelli within the septums are of the density characteristic of that individual from the crest of the septum to its base. This type is common and is extremely favorable for a permanent ridge form. The teeth can be retained indefinitely without interference with stability of ridge form.

The second type of recession is a localized infiltrative type of recession. In a roentgenographic sense, an infiltrated area is one in which the cancelli of that area register a diminished thickness and decrease in number when compared with the registrations of the cancelli characteristic of that individual. In this group, there is a recession of the crest of the septum which is not even as in the first class, but is irregular, and in individual septums, one side of the crest is receded more than the other. Instead of there being uniform density throughout the septum, there is a distinct line of demarcation noted near the crest. The cancelli nearer the cervices of the teeth from the line of demarcation are of decreased density or are infiltrated as a result of some osteolytic agent, while those toward the base of the septum are of characteristic density.

The affected crests may be localized in one portion of the jaw or may be generalized throughout both arches. This type of recession is usually associated with calculus and pocket formation, and when examined clinically, its appearance is frequently characteristic of the so-called "foul-mouth." Pus is readily expressible if not actually visible. The pockets which are present frequently contain marginal sac formations which can act as foci of infection and which many times are mistaken for hypertrophied gum tissue. This type of recession, unless the ravages are too severe, will readily respond to treatment, and if given the proper attention so that the calculus and marginal sac formations are removed, the teeth can be retained for extended periods without marked injury to the ridge form and without danger to the health.

If proper attention is not given, the osteolytic agencies may penetrate so deeply into the cancelli that remedial measures, such as trimming the ridge at the time of extraction, will be impossible, and the end-result will be unfavorable. The retention of the sacs in some instances apparently affects the character of the cortical layers so that the cancelli are exposed and the soft tissues, instead of resting against a smooth surface, are irritated by sharp ends of the cancelli when pressure is applied. Localization may result in the extrusion of spiculae into the soft tissues, which usually is an irritating factor.

The progressive infiltrative type of recession, the third type, is less frequently observed but is not rare. It is characterized by a V-shaped thinning of the cancellations within the septums with but relatively little break in the crest. There is no distinct line of demarcation between the infiltrated and the normal

cancelli. Clinically, this type requires frequent attention to preserve comfort instead of remaining corrected for long periods. There is little pus present, but a mild generalized hyperemia is noted. In spite of unremitting care by the operator, there is a continued recession both of the soft tissues and the supporting structures, and the teeth require early removal for comfort. Extraction is usually carried out one tooth at a time over a period of years.

This type of recession usually results in the knife-edge ridge of the recurrent type and these have been observed to progress so deeply that the geniohyoid tubercles were higher than the ridge itself. From observation of these cases, we believe that the early removal of the teeth is indicated, followed with a trimming of the ridge to as nearly the lower border of the infiltrative area as is possible without too much loss of the outer plates, if one is to expect a reasonably comfortable denture and relative permanence of ridge form.

Another factor which apparently is of diagnostic value in the observation of the supporting structures in the preoperative case is the presence of the vessel channels. Our observations incline us to the opinion that their presence is indicative of a thinning of the cortical layers and also of the width of the process, which is of value as an indication of the ultimate breadth of bearing surface for the piece. But if in addition we note that the channels are wider than usual, with their walls or margins hazy or infiltrative in appearance, the registration suggests a beginning of the knife-edge type of ridge.

Thus, we can classify the preoperative case as to the probable type of ridge which will occur and the prognosis.

In the edentulous case, we will note three types of ridges. The first class is the desired type, consisting as it does of broad, well-rounded ridges with a heavy, smooth cortical layer, the cancelli being of normal density and capable of aiding the cortical layers to withstand stress. This class apparently follows the first type of recession, and also the second type when there is favorable surgical interference.

The second type is registered roentgenographically by (*a*) a uniform density of the cancellations but with not apparent registration of the cortical layer or (*b*) uniform density of the cancelli, a cortical layer registration but with small areas of localized decreased density near the ridge, and (*c*) a definite cortical layer registration and excellent cancellar formations but with a thin knife-edge apparent.

The third type of recession leads to a third classification of the edentulous ridge. As the ridge is of the recurrent knife-edge character, surgical interference is of but merely passing relief. The cancellations are enlarged, the knife-edges approach the density of the soft tissues and the vessel channels are distinctly registered. One cannot be optimistic about this type nor can one expect satisfying results.

There is another phase of regenerative process following the removal of the teeth which will sometimes affect the comfort and function of the tissue-borne piece, and that is the presence of spiculae within the soft tissues. In a roentgenographic examination of an edentulous area, one may note the presence of spiculae within the soft tissues. Their presence is not of itself an indication that there will be discomfort beneath them. On the other hand, if there are persistent areas of localized irritation

beneath a tissue-borne piece and relief of the bearing surfaces fails to afford comfort, a roentgenographic examination should be made. Either spiculae will be noted in the soft tissues or small spinous processes can be observed. When spiculae are observed, but there is no irritation noted by the patient, one can be certain that they are being absorbed in a physiologic manner during their passage; but if discomfort is noted, they are either too large to be absorbed physiologically or they are being extruded as foreign bodies, and surgical interference will be necessary.

In all examinations to determine the factors which can influence the success of a tissue-borne piece, the soft tissue detail should be registered on the film unless the teeth are so close together that the embrasures are entirely filled; which would prevent a differentiation. This will register the presence of small spur formations which would interfere with successful results and will not burn out significant detail. The registration of the soft tissues in edentulous cases will reveal the presence of spiculae and small spurs which cause local irritation and which approach so closely the density of the soft tissues that if the latter were not apparent, they too would not be observed.

CONCLUSION

I should like to emphasize two points: (1) the observation of these facts has aided in the successful outcome of problems arising regarding tissue-borne devices, and (2) we do not minimize the necessity for attention to mechanical factors nor is any claim made that all cases which prove unsatisfactory are the result of failure to give attention to these changes. We do know that certain operators are finding the roentgenographic evidence of changes such as we have brought to your attention a helpful and vital factor in handling edentulous cases.

THE IMPORTANCE OF OPERATIVE DENTISTRY*

By JOHN V. CONZETT, D.D.S., Dubuque,, Iowa

SOMETIME ago, there was an editorial in the *Dental Cosmos,* lamenting the decadence of operative dentistry and asking where the great operators of the past were. Other writers, taking their cue from this editorial, attributed the loss of the prestige of operative dentistry to the advent of the gold inlay. Whether there has been a falling off of operative efficiency in the rank and file of the dentists of today, I am not capable of saying, but that operative dentistry has been relegated from its proud position of importance and primacy to a position third or fourth in the estimation of students of dentistry today is a fact that cannot be truthfully denied. The reason is not, in my opinion, the advent of the gold inlay; for though the inlay, by its apparent ease of manipulation, has had an evil effect on some of the men who are always seeking the way of least resistance, these men are not the ones who would be most eminent in

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operative dentistry with any method. In fact, the gold inlay requires as great a degree of skill as does the gold filling. The real reason for the temporary eclipse of operative dentistry is the hysteria that was inaugurated in the ranks of the dental and medical professions by the theory of focal infection. Led on by men of reputation, thousands of men of lesser caliber swallowed the theory, hook, line and sinker, and began the terrible massacre of the innocents. As a result, oral surgeons were born overnight, and in their wake followed, as a logical sequence, the prosthetic specialist, and the removable bridge specialist, the removable bridge being our old friend the clasp plate rechristened for financial reasons. It is easier to collect a big fee for a removable bridge than it is for a partial plate. The boys in school and the men in practice found that the public were willing to pay big fees for the extraction of teeth with big "pus sacs" at the apices, that were sapping their lives away, and every dark area that showed in the roentgenogram was an abscess, or pus sac, and had to be sacrificed. Men of reputation went from society to society and from school to school preaching the terrible danger of allowing an infected or "dead" tooth, to remain in the mouth, and the dentist became alarmed at the prospect of having malpractice suits brought against him by patients to whom he had given his best service. The consequence was that it became the style to condemn the so-called "dead" tooth, and the 100 per cent vitality men held the boards for a season, with clamor and éclat. It became almost a crime to save a tooth, and operative dentistry hung its head and took a back seat.

But has it lost its real importance? I trow not: to me operative dentistry is still king, and the art of saving the natural teeth is so far ahead of the art of supplying artificial substitutes that they should not be mentioned in the same breath. The Creator gave us teeth for physiologic and esthetic reasons, and while it is true that, owing to the exigencies of our civilization, these masterpieces of creation fall into the evil ways of caries and pyorrhea, and if not cared for in the most skilful manner, are lost to their hosts, it is also true that the genius of man has been able to stay the ravages of decay, and at least ameliorate the progress of pyorrhea, so that the vast majority of the teeth of the present generation can be preserved to old age if the dentist is given half a chance. The fetish of focal infection in its radical aspect is losing ground, or perhaps we might better say, the theory is finding its proper place. We do not for a moment desire it to be understood that we stand for the preservation in the mouth of hopelessly diseased teeth, nor do we advise the retention of suspected teeth in cases of systemic disease that may be due to a focus somewhere; but we do decry the extraction of teeth that may be saved by rational treatment, particularly when they are ordered out before a search has been made for a focus somewhere else. It has been the experience of dentists everywhere that physicians have ordered teeth out in cases of systemic disease, with no benefit to the patient, only to find thereafter a toxic focus somewhere else, the removal of which had the desired effect of relieving the patient; but the teeth were gone. I do not ask the retention of diseased teeth; I only ask that the same consideration be shown the teeth that is given to the other organs of the body. Let it never be misunderstood: The patient's health is paramount to the retention of teeth, tonsils, appendixes, gallbladders or what not.

In what respect, then, is operative dentistry important; and, if important, in what relation does its importance stand to dentistry's specialties?

The function of operative dentistry is to save the natural teeth, and as far as it fulfils its destiny, it stands first in the field of dentistry. Today, we know that infection through the medium of the dental organs does not come through the pulpless tooth alone, nor its partner in crime, the tooth affected with pyorrhea; but thanks to the researches of Collins, Hartzell and Henrici, we now know that when a tooth has been affected by caries to a considerable degree, the pulp of that tooth is affected and the organisms of disease can be demonstrated in the pulp tissue. Here, there is no granuloma—if we may use that much abused term—to ward off infection from the blood stream, but the infection has direct access to the vascular system through the veins of the pulp, and many cases of systemic disease apparently caused by degenerating and infected pulps have been noted by careful observers. The observers above mentioned also found infected pulps in the teeth that were badly pyorrheic, and degenerating and infected pulps in teeth that were deeply carious and pyorrheic. It becomes the duty, then, of the operative dentist to prevent this untoward result, and only the operative dentist can do it: either that, or extract every tooth that is at all affected with caries or pyorhea. Which horn of the dilemma will he grasp? Extract the teeth and give dentistry into the hands of the prosthetic specialist, and ring down the curtain on the profession that we all love, and to whom we have given our life's service? Or grapple with the problem in a scientific manner, and bring glory to the profession, and benefit to humanity, whom we should serve? I am glad to say that dentistry answers, almost unanimously, that it will carry on and save the teeth of the race, for in so doing it will do much to save humanity from degeneration. If dentistry is to do this much desired work of health service, it must be done through the agency of operative dentistry. Oral surgery cannot do it; prosthetic dentistry cannot do it; neither can any other branch of the profession, unless prophylaxis claims a hearing, and we gladly give it to her. But we claim her as the legitimate daughter of operative dentistry, and we must have her services in our field, for we cannot do without her.

The dentist of today calls his patients into his office for inspection at frequent intervals, and, in the cleaning and polishing of all of the surfaces of the teeth, assures real prophylaxis as regards both caries and pyorrhea; for a clean tooth without structural defects will not decay, neither will a perfectly clean gingival margin afford a harbor for beginning pyorrhea, and therefore the real cleaning and polishing of the teeth will do more to prevent dental diseases than any other thing that we can do.

It is a work of supreme importance to find defects in the teeth at the earliest possible moment, and frequent inspection and cleaning of the teeth affords the best opportunity for finding them. Indeed, the ordinary examination of the teeth will frequently miss cavities in their incipiency, and it has been a frequent experience to find patients with well defined cavities who claim that they have been recently in the hands of a dentist who has failed to find any defect. Such experiences are embarrassing, for one dislikes to criticize a fellow practitioner, yet must, in justice to the patient, point out the defect and remedy it.

The critical examination of all surfaces of the teeth is the paramount duty of the dentist, to determine their real condition, and if the slightest defect is found, he must point it out and remedy it.

The use of the various pointed explorers is obviously necessary, and any place in which the sharp tine of the explorer catches should be carefully inspected to determine whether the catch is in a defect or not. The sulci of all the teeth should be most carefully examined, for frequently in young children the enamel plates fail to fuse together and a fissure is left which in time will be a cavity. Such fissures often form nesting places for the invading bacteria of decay; and, operating under the protection of the overhanging enamel, they carry on their work of destruction, until the breaking down of the enamel discloses a very large cavity. Indeed, it has been my misfortune to find cases in which the entire dentin of the crown of the tooth had become carious before the enamel broke down, and the result was a badly infected pulp and loss of the pulp. In such cases in young children, the ultimate loss of the tooth is anticipated.

The mouth lamp is very serviceable and will detect cavities that are otherwise undetected. It should be used as a routine procedure.

The winged roentgen-ray films suggested by Howard R. Raper are invaluable in discovering defects in the proximal surfaces of the teeth. Their use is indicated in all cases in which a survey of the mouth is made.

When the operator makes his examination and finds difficulties, it is up to him to suggest the necessary reparative treatment, and, in my opinion, it should be that which will afford the highest service to the patient. There are many means of filling teeth: the gold fillings and inlays, the porcelain inlay, the amalgam filling and the silicate cements. It is not the province of this paper to enter into a discussion of the merits or demerits of the various methods and materials. The only thought in my mind is that the operator shall use the method and the material at his disposal that will accomplish the most for the patient. It is a common fault for an essayist to demand the treatment of the patient at the hands of the ordinary dentist that he, the expert in some particular line, would give to one in his care. This is obviously unfair, for the average dentist may not have the ability to use the method or material that is suggested by the expert, in a way that will be of benefit to his patient. Each man must be the judge as to the material or the method which in his hands will best serve his patient, always being cognizant of the fact that if he fails to perform a service to his patients that will give fairly permanent results, the odium will fall on him, and the result will be a loss of prestige and practice. "To thine own self be true, and it will follow as the night the day, thou canst not then be false to any man."

Let me urge on the younger men of the profession espousal of the cause of operative dentistry, for I know of no branch of the profession that will bring results more satisfactory to the practitioner or to his patients, if the dentist has carefully prepared himself for the splendid task of saving the teeth.

DISCUSSION

C. N. Johnson, Chicago, Ill.: Dr. Conzett has made the inference that operative dentistry in recent years has been relegated to the position of third or fourth place in importance. There has been more than one reason for that. One reason he stated a moment ago—that the concentration on the subject of focal infection and the relation of pulpless

teeth to that question has focused the attention of the profession on the extraction of teeth, the destruction of teeth, rather than the salvation of teeth. It has been almost a disgrace in recent years to try to save a natural tooth and practitioner did not get much credit for it. I have felt guilty on many occasions for trying to save the natural teeth, but I have been trying to save them. And I think the time will come when we will blush a little bit for many of the teeth that have been taken out. There is another reason that operative dentistry has not been in the limelight so much: when it became necessary to insert partial dentures and full dentures, there arose at once a question of the proper method, and that question has not been settled yet, according to the discussion a few minutes ago. In operative dentistry, I say this not because I have been an operative dentist, but because it is a fact, the theories have been more settled and standardized than those of prosthetic dentistry. There has been a great deal of discussion in prosthetic dentistry, and that leads to an interest in the subject; but, in operative dentistry, the procedures have been so systematized that it has not been necessary to discuss the technic to the same extent that it has been necessary to discuss prosthetic dentistry. When we encountered a cavity and it had to be filled, we knew how to do it, and we still know. Some of us do not live up in our practice to our knowledge, but we do know how to fill teeth, and that is one reason why operative dentistry has not been discussed more in recent years. Dr. Conzett has talked about the "hysteria." I am glad he used that word. I wanted to use it, but I did not have the courage: the hysteria of extracting pulpless teeth—and he left the inference that we were getting over that; but I want to say we are not all over it yet. I am going to take the liberty of mentioning several cases that have come under my own observation. A patient who had not been in Chicago for a time—she formerly lived there, but went out to one of the country towns—reported back to Chicago a short time ago, with the statement that she had to have all her teeth extracted. I looked at her mouth, and said, "Why?" "Well, because they are infected." She had twenty-four natural teeth, and I said, "We will see about this." We had some roentgenograms made, and there was not a single pulpless tooth in that woman's mouth, not one, and there was not any pyorrhea. There was not anything wrong. God save us when we have that kind of advice given in our profession today, on account of the concentration that there has been on the necessity for cleaning out the mouth. I blush for my profession. One of my associates said to me, "How do you account for that?" I account for it on the ground that this man had just recently taken a postgraduate course in full denture construction. Dr. Conzett mentioned an idea that has been emphasized quite extensively recently, and that is the fact that we can find micro-organisms in the pulps of teeth that have not been destroyed. Now, we see references to that, and I am afraid that that is going to be held up as a great bugbear. Of course, we may find micro-organisms in the live pulps of teeth. What of it! Is there any tissue of the body in which you cannot find micro-organisms? How do we know that they are doing any damage? You know, it requires a great stretch of my imagination to believe for one minute that a few micro-organisms in a pulp of a tooth are going to ruin the health of a patient. We get these scares once in a while. I do not want to see a scare of that kind started, because I am afraid my physician or some friend of mine is going after the pulps of my teeth, and I have never lost a pulp yet, and I do not want to begin. The significant thing in operative dentistry—in fact, in all dentistry—something that Dr. Conzett referred to inferentially a few minutes ago, is the question of prevention. We have been going over this field of the technic of filling teeth, the technic of inserting artificial dentures; we have been giving it the best attention we know how to give it, but we have not early enough in our history gone into the prevention of dental decay or the prevention of pyorrhea. I want to second Dr. Conzett, when he says that this matter of prevention is operative dentistry, because I believe in most of those cases in which we have brought about a condition of immunity in the mouths of our patients, it has been brought about by the practice of operative dentistry. I do not minimize by any means the importance of diet in the control of these diseases, but I am going to ask our dietitians two things: first, to agree on a diet among themselves, and then to prove to us that they have the ideal diet for every case—which I do not think they can do, but if they can, I am going to put up to them the

problem of making the people follow that diet. And I think I will start with the medical and dental professions, and I am going to see how many dentists out of this group or any other similar group will follow a diet that has been proved to be the best diet for them. Another thing: I am going to watch the children that grow up, and I am going to see our dietitians control the diet of the children to make it ideal and make it uniform in all children—which I do not believe they can. There has been a very important study along that line in recent years. Certain children have been permitted to select their own diet. Food materials that we use in our homes have been placed on a table and the children have been permitted to reach out and get whatever they desired. Those babies do not all select the same diet. We are not all built the same, and the diet that might be good for you, might not be good for me, and the diet that might be good for me, might not be good for you. That does not mean there is no science in the matter of diet. I am a believer in diet, but I do not believe that we know all about it yet. I hope our dietitians will go a little bit farther. Our profession experiences certain waves of interest. As Dr. Conzett has mentioned, it is experiencing a wave of interest in prosthetic dentistry. A short time ago, there was a wave of interest in diet. It may have done us some good: I hope that it did. Now another subject is looming on the horizon, dental economics. And we have to look out for it. If there is anythi. g that can demoralize us, it is that. You have not recently seen many papers on diet. I believe we should study diet, but I do not believe we should go to the extreme that some of our speakers have advocated, because I do not believe that we can stop dental caries by diet alone in all cases unless we can start early enough, start long before birth. But we can stop dental decay by the best practice of operative dentistry. We who have practiced any length of time in the one neighborhood, have seen children come into our offices, month after month, year after year, reaching the twenties or adult life without the loss of a pulp of a tooth. Many have a perfect set of natural teeth at the age when their own parents had lost many teeth. If we carry that service on, generation after generation, living up to the light that we have today presented to us in operative dentistry, we will soon have a generation without any tendency to decay at all.

Victor H. Fuqua, Chicago, Ill.: The statement that operative dentistry has been relegated from its position of importance and primacy to a position third or fourth in the estimation of students of dentistry today is indeed a lamentable fact. However, I am cheered by the optimism in the statement that operative dentistry is suffering only a temporary eclipse. In dentistry, as well as in all other professions, trades and occupations, the pendulum swings to and fro, from one extreme to the other; there is a changing from the old order of things to the new. In all progress, there must be change. New ideas, new methods, new scientific facts come to light, and they must be properly tried out, correlated and put in their proper places. We move on just the same, and sometimes we have to go backwards for a while in order that we may go forward again. This is true of nations, professions and individuals. I am not sure that I agree altogether with Dr. Conzett in the reasons given for the decline of operative dentistry. The so-called "hysteria" regarding extraction of teeth has had its value, and has opened up great fields of scientific research for both the dental and the medical profession and, in consequence, humanity has been benefited, and the importance of skilful conscientious dentistry has been brought to the attention and consideration of the public during the past ten years as it has not been in the whole life time of our profession. I have no tears to shed in memory of the departed pulpless teeth, even though some of them were useful and healthy members. Our great scientific laboratories and their research workers have taught the dentist, and the public press is helping teach the layman, the dangers of focal infections. To those of us who have given the best portion of our lives to the study and practice of operative dentistry, it is indeed painful and discouraging to view the mouths of patients that once carried monuments of our skill in foil, porcelain and gold inlays, wrecked by the forceps and their places taken by the tawdry, gilded removable bridge. However, I am not discouraged about the future of operative dentistry. We are "coming back" when all these pulpless teeth carrying infection are gone and the next generation is sufficiently educated as to the value of frequent visits to the family dentist. With the common knowledge of

mouth hygiene and preventive dentistry and the dentist's appreciation of the value of healthy living pulps and the dangers of pulp extirpation and root canal fillings, we shall be on our way to progress. The conception that conservation of tooth structure and pulp is the most important service that we as dentists can render humanity is a true one, and the successful practice of operative dentistry brings a satisfaction like nothing else. Notwithstanding the present day lack of interest in operative dentistry, I prophesy that in the not far distant future there will be a return to former interests and practice. There will be a burnishing and polishing of the long since rusted foil pluggers, a warming up of the old porcelain furnace and the practice of a more careful technic in the handling of the gold inlay. "To thine own self be true" quotes Dr. Conzett, and I would not be true to myself if I did not mention one factor which, to my mind, has done most to cheapen and undermine the once high standard of operative dentistry; the indiscriminate use and the abuse of the silicate cements. Why use a material so poisonous to healthy pulp tissue? Why use a material with which contact points cannot be made or maintained?

Emil L. Aison, Chicago, Ill.: This is too important a subject to be passed up without further comment. Certain remarks might be misinterpreted by some in the audience. If there is any solution to the problem that we are confronted with now, it will be found in operative dentistry. By that, I have in mind prevention and a thorough study of methods thereof, possibly with the aid of liberal endowments. I have felt for a long time that more effort should be directed in this particular channel. We all know that of the several themes dominating the minds of the medical and dental profession today two are most outstanding: the relationship between dental and systemic disease, with the many intricate pathologic ramifications, and prevention of dental disease and, consequently, the prevention of all the destructive sequelae. The one inspires and calls forth the other in inevitable sequence. To understand the sources of the differences of opinion in our own ranks regarding focal infection and as to what is the proper dental procedure, a bit of history is necessary. Up to the time when dentistry has largely broken away from the traditional notion that it was a mechanical art and a cosmetic need rather than a factor in health and disease, little or no thought was given by either profession to the need of coordination between medicine and dentistry in the treatment of the sick. As a result, even the leading men of dentistry have focused their attention on and directed their energies practically entirely toward one phase of their work, namely, treatment of caries and artificial restoration of lost dental organs. With the advent of newer thoughts on the etiology of disease, notably the researches which brought to light the influence diseases about the teeth and associated structures exert on remote parts of the body, a tremendous impetus was given to a new and formidable movement for the public good among the thinking men of these two professions. However, there are those in our own ranks who are still skeptical toward procedures aiming to abolish practices which have proved antiquated. But this need not be discouraging. The history of medicine, dentistry and the sciences, indeed the history of mankind itself is replete with evidence of opposition to new and revolutionary developments. The accepted medical and scientific attitude toward most new things has always had and always will have three stages: First, it does not understand and so ignores them. Secondly, it becomes sarcastic and irritated about them. Thirdly, it sees the good that is in them, accepts them and forgets that it has not always done so. Now we recognize that while modern procedures in medicine and dentistry, particularly those dealing with the eradication of local foci as a means of either preventing or alleviating body disease, have relieved much suffering and saved many lives, some results were disappointing. Why? First, because in many instances entirely too much was expected, via the extraction route, in cases of serious and sometimes hopeless secondary pathologic involvement which was much more grave and much more difficult to cope with than the initial focus responsible. For instance, in the case of proliferative arthritis resulting from local infection, dental or otherwise, a condition exists which may not clear up or improve even after the initial focus has been removed, on account of definite, permanent pathologic changes in the nature of abnormal bone formation which have taken place. Secondly, because fadists and fakers have taken advantage, as they have always done, of a gullible public on the promise of a cure for all ills and thereby cheapened and

vulgarized honest effort. The doubters have taken the unfavorable results at their worst. Others, either because of ignorance or convenience, prefer to continue in a state of illusion regarding the focal infection theory. Still others are frequently motivated by a wish rather than by scientific reasoning. Now, it would be folly to hug to our breasts the comforting thought that extraction of teeth is a panacea of all ills. But science is not dogmatic: it is rational, impersonal and open minded. There is too much evidence to show that poor dentistry and resultant infection, in more instances than is generally appreciated by those of us who are not in touch with hospital clinics, clinical conferences and laboratory studies, is a direct or contributing cause of metastatic infection, of cardiovascular disease, gallbladder and urinary bladder infection, kidney disease, metastatic lung abscess, septic endocarditis with emboli, subacute and acute anemia and of other forms of blood dyscrasia, myositis, arthritis, nervous diseases and several different types of eye disease. Here we have stern realities, not Utopias to reckon with. They strike at your very heart when you yourself happen to be a victim, and there are many such in the professions. To overlook or underrate is not conservatism; it is extreme radicalism. Others undergo different degrees of reaction to infection, dental and otherwise. This depends on individuality, resistance, age, virulence of micro-organisms, etc. Mistakes have been made no doubt by the overzealous of the newer school of thought, but all the errors, criticisms, analysis and comparisons have not dimmed the luster of the good that has been accomplished. Even the ultraconservatives admit this, in their lucid moments. This is an encouragement and incentive to every earnest worker concerned with public health and in control and eradication of disease. What should be our outlook and aim for the future? I would say a more vigorous and systematized study of methods of prevention aiming to confer immunity to dental caries. But until this ideal has been evolved, and with our present knowledge, we can hope only to control and diminish dental disease but not abolish it. Therefore, early operative dentistry as emphasized by Dr. Conzett is the proper and only device that we have at the present time. Early treatment of caries and the investing tissues of the teeth, superior skill and ever improved refinements in dental technic are, of course, of great importance and should be kept up if we are to continue to justify our present position. But the solution to the serious problems confronting the dental practitioner today lies in his willingness and ability to so widen his educational scope and interest as to be able to understand the biologic forces governing health or disease in general, and so correlate his efforts with the other specialties of medicine as to become even a more important factor in public health conservation than he already is. For, with the progress of time, more is expected of him and his responsibilities have accordingly increased. Be not the first but neither be the last in adopting newer and more progressive measures in your chosen work, for the march of progress is ever going on.

Dr. Conzett (closing): I do not ask for the retention of diseased teeth; I have tried to emphasize the fact that health is paramount to the preservation of any diseased tooth, and if the teeth are hopelessly diseased, they should be taken out. I simply decried the extraction of all pulpless teeth. Dr. Johnson mentioned a thing this afternoon that has been on my heart and mind for some time. I do not wish for a moment to criticize the general oral surgeon. Some of the finest men in the world, some of my best friends, are oral surgeons; but there are men who are out in the profession evidently for the simple purpose of taking out teeth and getting the fee for doing it. And I have almost come to the conclusion that it may be necessary, at some time, if things continue as they are, to say that an oral surgeon should not say when a tooth shall or shall not come out, but that the general practitioner shall be the man to determine finally whether the tooth shall be extracted. A short time ago, a dentist in a neighboring city wrote to ask me to look over the teeth of a school teacher who had been told all of her teeth should come out, because of pyorrhea. She came in with some roentgenograms that had been taken in a neighboring city, and I first looked them over. I said, "Why, there is very little evidence of pyorrhea here." She said, "This oral surgeon, dentist and roentgenographer said that all of my teeth must come out." I thought that perhaps the mouth would show conditions that the roentgenograms did not show, but I have never seen gums that were healthier. There was very slight evidence of absorption of the alveolar process, no pus and

no inflammation; but all of the teeth to the right side distally from the cuspids, above and below, had been recently extracted. The patient said that this dentist placed her in the chair and before she "came to," he had all those teeth out and was going to take all of them out. She said, "*Now*, what can I do?" Well, what *can* you do, with a mouth in which all of the teeth are in, from the right cuspid to the second upper molar above and below, and all the teeth are out, distally, to the cuspid above and below? It is a difficult proposition. I said, "We could save the rest of the teeth," and we are saving the rest of the teeth. That is one of many cases. I do not mean to say for a moment that all physicians or roentgenographers will do that, but there are too many, and I say there is a time for this hysteria to be stopped. Dr. Johnson brought out so many splendid points; he opened up so many doors, it would be impossible for me to enter them all. One concerned diet. That is a tremendous factor in health, as Dr. Johnson recognizes. We all recognize that, and we must recognize it and take it into account more and more in the future; but the diet of the individual will not save the teeth now. We have to go back farther than diet. As Oliver Wendell Holmes says, "In order to create a man we must go back to his grandfather or grandmother." In order to create teeth, we have to go back to the grandfather or grandmother, and control the diet of the mother, then of the child. And if we can control the diet of the mother and the child—and I grant you we cannot do it now and I doubt if we ever will be able to do it—we will prevent a large percentage of the caries which destroys the teeth of the present generation, and of the coming generation. Percy R. Howe is doing some wonderful work along these lines. Dr. Black, many years ago, took 10,000 teeth, made a chemical and physical test and found them all practically of the same density. So we threw aside the old theory that there were soft and hard teeth. That was followed up by Williams in the study of the enamel. He said it does not make any difference whether the dentin is hard or soft, because primarily the dentin does not decay. You never saw decay start without a break in the tooth. If the enamel is perfect, the dentin will not decay. Howe has been able to demonstrate in the teeth of animals the softening of the dentin under dietetic conditions; but that does not affect the enamel. He showed me some slides which seemed to demonstrate that possibly the dentin could decay but we have never been able, and he has never been able, to show any case in which there has been any decay inside the tooth that has not been first on the outside. Thus, diet may control the building of the tooth, and it may possibly control the density of the dentin, but I do not believe it has ever been demonstrated, and I doubt if it ever will be, that diet can have anything to do with the condition of the enamel after it has been formed. But diet will affect the tooth in this way: It will affect that tooth by placing in the digestive system, in the blood stream, in the saliva, a certain amount of carbohydrates on which the bacteria of decay can live and proliferate. And then if the bacteria can plaster themselves on any particular surface of the tooth (the bacterial plaque), we will have the beginning of decay, through the chemical parasitic theory, which I believe has never been overthrown. Dr. Johnson elaborated on the thought which I touched on, infection of the pulp. Now, we know that pulp may be infected to a considerable degree. I used to wonder sometimes why it was that a tooth I had filled which had a small cavity might come back to me after a period of three or four months or two or three years, with a dead pulp, in form of an abscess. Now, we know that that pulp was infected before that filling was placed in there. That pulp may overcome the infection. If it does, the pulp is going to live. If it does not, it is going to die. Now, I believe that it is a great deal better to destroy a pulp that is degenerating, a pulp to which decay has come so close that there is no doubt about its being badly infected, and fill that root to the best of our ability. A black area at the end of a tooth does not necessarily spell the destruction of that tooth. Next summer, I am going to present a paper on the treatment of pulp canals, and I am going to show pictures of teeth that have so-called granulomas; teeth with these areas, then with the pulp canals filled, and then I am going to show roentgenograms of those teeth after two or three years in which the area has disappeared and the bone is filled in. If it can happen once, it can happen again.

CANCER OF THE MOUTH FROM A DENTAL STANDPOINT*

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THAT cancer is one of the greatest problems that confront mankind is generally realized and acknowledged. That cancer of the mouth makes up one of the larger groups of cancer, while realized by those familiar with the cancer situation, is not sufficiently well realized by the medical and dental professions. Not only that, but cancer of the mouth, from a dental standpoint has been sadly neglected. We have therefore attempted this brief study.

It has seemed that the dental profession as a whole has been most unmindful of its duties and responsibilities in this respect, possibly owing to the fact that it has been felt that cancer is primarily a problem of general medicine and but rarely concerns the dentist. Also, there has undoubtedly been too much of the attitude: "What is the difference? If it is cancer, we can't do much about it anyway."

While cancer is primarily a problem of general medicine, cancer of the mouth, especially in its earliest stages, is seen (although not recognized perhaps) primarily by the dentist and far more frequently than we have any conception of. Further, in many ways, cancer of the mouth should be to the dental profession what cancer of the uterus, breast or stomach is to the medical profession, and, lastly, may we not ask this question concerning the etiology of cancer: Do we not have a better opportunity in the mouth, a place which is so easily accessible, than in some organ such as the breast, uterus or stomach for a study of the earliest development of the condition in order to find its cause?

Had the same amount of work and study been devoted to cancer of the mouth as has been given to cancer in other parts of the body, our knowledge of the subject would be far in advance of what it is now.

PLAN OF STUDY

In the results of the study that we are about to present, the following plan will be adopted:

A group of questions on this subject, the correct answers of which are of vital importance, will be presented, after which we will attempt to answer them by studies of our own material, and by comparison with accepted teachings. Where possible, conclusions will be made.

With these things in mind, before presenting the questions, it seems advisable first to explain how our material was obtained and studied, and, secondly, to make a few general remarks about the deficiencies of the literature.

SOURCE OF MATERIAL AND METHODS OF STUDY

Practically all of this material is from cases from the oral surgery department

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of New York University College of Dentistry.

From July, 1925, to October, 1928, we have received about 500 pathologic tissue specimens. During this time, thirty carcinoma cases were among them. We have especially selected these cases as we do not wish to include benign epithelial tumors or connective tissue tumors in this report.

At the time of biopsy, histories were taken on these cases and, subsequent to diagnosis, all of them were referred elsewhere for treatment; hence, the difficulties of follow-up histories are apparent.

Much of the incompleteness of our records is due to the fact that these were clinic cases, in which complete and thorough physical examinations and histories were not made and, further, that many of them were seen but once, and it must be further emphasized that as a larger part of this study is one of records, an unusually small number of records, we will, in view of the obvious pitfalls offered in drawing any conclusions, endeavor to be most careful in this respect.

REVIEW OF LITERATURE

After a fairly comprehensive (we do not claim complete or exhaustive) review of the literature, we are impressed by its deficiencies in respect to carcinoma of dental interest.

Of those textbooks with which we are familiar, most in use at the present time for dental students, no mention is made of carcinoma in the mouth.

Of five dental textbooks on pathology, in one no mention of carcinoma is made; in another, it is mentioned in association with leukoplakia; in another, carcinoma of the tongue and lip but not of the gums is dealt with, and in but one is the subject covered comparatively well.

Most medical textbooks on pathology stress carcinoma of the tongue and lip to the exclusion of carcinoma of the gums. In a few, carcinoma of the gums and cheek are lightly dealt with.

Two authoritative works on tumors and one rather complete statistical report on cancer, references to which will be made later, deal with the subject more fully.

Of other available literature, most of the articles we know of deal with carcinoma of the lip and tongue. Some of them have to do with carcinoma in other parts of the mouth in which attention is particularly called to precancerous lesions.

GROUP OF QUESTIONS

While obviously there are many factors in carcinoma of the mouth that we should like to know, in the formulation of our questions, we have been guided by two purposes: 1. To make such questions that a justifiable answer could be attempted from a study of our material. 2. To select questions of especial importance to the dentist.

Frequency.—What is its frequency? Can we make any comparison as to past and present?

Comparison with Other Tumors.—How does it compare with other tumors of the mouth? Is there any relationship between these tumors?

Color; Sex; Age.—In what way are color, sex and age factors?

Location.—How is location a factor? Is there any difference in frequency as to involvement of upper and lower jaw?

Pathologic Classification.—What type of cell growth makes up these cases?

Earliest History of Lesion.—What factors are most frequent? What rôle does tooth history play? What is the significance of failure of gums to heal after extraction? What is the significance of chronic irritation? Are any special forms of leukoplakia more liable to cancer? In

what way are papillomas, fissures, ill-fitting appliances, ill-directed treatment, factors?

Tobacco.—How is the action of tobacco to be considered?

Tuberculosis and Syphilis.—What are the most important practical points to be borne in mind in relation to tuberculosis and syphilis?

Pain.—What is the significance of pain?

Loss of Weight.—Does loss of weight occur? What influences loss of weight?

Lymph Gland Enlargement.—What does the presence or absence of lymph gland enlargement mean?

Outcome; Ultimate Behavior.—What conditions influence the outcome? What is the value of "time of duration" from a prognostic standpoint? What is their expectancy of life? How does character of growth influence behavior? Of what value is a knowledge of cell differentiation? Is the age of the patient important? How does location influence outcome? Can carcinoma in this location be cured? Does treatment benefit these cases? How is septicity a factor? Of what significance are accidents?

Biopsy.—What is its value (points for and against)? What are its limitations?

FREQUENCY

Frequency of a condition does much to make such a condition important. In its consideration, we will be brief. Permit us to quote Ewing,[1] who writes, "In frequency, it [referring to epidermoid carcinoma of tongue and month] is placed by Jessett second only to uterine cancer, by Jacobson third, and by Winiwarter fourth."

As carcinoma of the uterus and breast make up the most frequently occurring groups of carcinoma and taking into consideration the fact that cancer in the location with which we are concerned is chiefly found in males, we can readily appreciate how frequent and important carcinoma of the mouth is to men.

In view of the fact that three cases with involvement of the antrum are included in this report, let us quote Ewing[1] again in respect to the frequency of antrum carcinoma. He states that of 1,892 cases of cancer admitted to Memorial Hospital in 1916-1917, thirty-five were carcinomas of the maxillary sinus.

References to the relative frequency of involvement of different parts of the mouth, other than lip and tongue, are scanty, but one gets the impression that next to these locations the gingivae and floor of the mouth are to be considered.

Lastly, is there a difference in the frequency of this condition at the present time as compared with the past?

While we cannot absolutely answer this question, it seems likely that the apparent increase of these cases today over yesterday is most probably due to improved diagnosis. Bloodgood,[2] in an article on cancer of the mouth which is largely a plea for prevention, makes a comparison between the cases seen at Johns Hopkins prior to 1900 and since 1920 in which he makes the following observations:

Up to 1900, 97 per cent of patients had waited and had local lesions which were cancer; 3 per cent only came under observation before the cancer had developed. Since 1920, 40 per cent of cases are cancer and 60 per cent are innocent instead of 3 per cent. Fifty-five per cent of those cases before 1900 were hopeless, while since 1920 less than 10 per cent are hopeless and more than 50 per cent are in the early stages of cancer.

1. Ewing, James: Neoplastic Diseases, Ed. 3, 1928.

2. Bloodgood, J. C.: Cancer of the Mouth, West Virginia M. J., 22: 316-317 (June) 1926.

COMPARISON WITH OTHER TUMORS

It is exceedingly difficult to answer with any degree of accuracy the questions: "How does carcinoma of the mouth compare in frequency with other dental tumors, benign and malignant?" and "Is there any relationship between such tumors?"

Textbooks emphasize the frequency of epulis, radicular cysts and granulomas and dentigerous cysts. Adamantinomas are referred to as rare.

Of about 500 consecutive pathologic tissues from our oral surgery clinic, the relative frequency of these tumors mentioned, including our carcinoma cases upon which this study is based, was as indicated in Table 1.

TABLE 1.—RELATIVE FREQUENCY OF TUMORS IN 500 PATHOLOGIC SPECIMENS

Carcinoma		30
Epulis		
a. Benign giant-cell sarcoma	46	71
b. Fibrous epulis	17	
c. Fibro-angiomatous epulis	8	
Radicular cyst and granuloma		59
Dentigerous cyst		9
Adamantinoma		9

While one realizes at once that no conclusions are justifiable, as neither all cases nor all tumors were subjected to "tissue examination," one must at least be impressed with the relatively large number of carcinomas and adamantinomas.

As far as any relationship existing between epulis and carcinoma is concerned, we wish to emphasize that, in our opinion, none exists.

It is easiest and most satisfactory to dispose of color, sex, and age together, and accordingly we have prepared Table 2. Even though the subject of location deserves separate and special consideration, we have included location in the table because it may be a factor modifying age.

TABLE 2.—COLOR, SEX AND AGE, WITH LOCATION

	Number	Color	Sex	Age
Upper gum	3	W	F	45
	11	W	M	84
	13	W	M	67
	29	W	M	69
Roof	16	W	M	45
Antrum	1	W	M	31
	5	W	M	80
	27	W	M	28
Lower gums	4	W	M	55
	6	W	M	63
	7	W	M	69
	8	W	M	52
	10	W	M	52
	15	W	M	71
	17	W	M	53
	19	W	M	45
	23	W	M	60
	25	W	M	65
	30	W	M	65
Floor	2	W	M	59
	9	W	M	63
	14	W	M	61
	20	W	M	68
	24	W	M	57
	26	B	M	65
	28	W	M	76
Tongue	12	W	M	44
	22	W	M	62
Cheek	18	W	M	40
	21	W	M	36

Color.—References to carcinoma in the negro are indefinite. Barker[3] finds that cancer in the African negro is rare. One of our cases was in a negro; the remainder were all in whites.

Sex.—Various authorities (Ewing,[1] 83 per cent; Boyd,[4] 85 per cent) speak of the marked preponderance of carcinoma of the mouth in males (the statistics are largely based on cancer of the lip or tongue). The majority give the figure around 85 per cent. Schmidt[5] says "While carcinoma of the tongue is most frequent in men it is not uncommon in

3. Barker, J. E., New York City: Cancer, E. P. Dutton & Company; p. 58, 1924.

4. Boyd, W.: Surgical Pathology, 1925.

5. Schmidt, W. H.: Cancer of Tongue, J. A. M. A., 89:1321 (Oct. 15) 1927.

women." Brofeldt,[6] in an article on leukoplakia and carcinoma of the lip, had sixteen females in fifty-one cases, and Bland-Sutton[7] mentions the preponderance of carcinoma of the lower lip for males, but an equal incidence in males and females in carcinoma of the upper lip. Quoting Davis, he states[7] that betelnut cancer in the cheek is more frequent in women owing to their practice of chewing betelnut. One of our series was from a female; the remaining twenty-nine were from males. The marked preponderance of males is striking.

It is of interest to note here that, in relationship to leukoplakia and syphilis, which may be related to cancer, while the former is more common in men, it is not infrequent in women, and that syphilis is equally common in both sexes.

Age.—It is quite universally accepted that the cancer age is over 40. We also know that carcinoma of the cervix uteri, breast and gastro-intestinal tract occurs frequently enough below 40. The usual age incidence for carcinoma of the tongue and mouth (Ewing,[1] carcinoma of the lip; Boyd[4]) is from 40 to 60. That for carcinoma of the antrum (Bland-Sutton[7]) is past middle life. As many references in respect to age can be cited, all of which are practically in agreement. We quote only a few of the most authoritative.

It will be readily observed that while, in a general way, our findings are decidedly in keeping with the foregoing, the following remarks seem warranted:

There is a tendency for our figures to run even above from 40 to 60 years.

If we look at these cases according to locations, it is of decided interest and perhaps importance to note that our two youngest patients, No. 1, aged 31, and No. 27, aged 28, presented two of the three antrum cases. Also in both in which the cheek was involved, the patients were comparatively young, No. 18, 40, and No. 21, 36.

A question that we would like to ask, based upon our findings, but one we dare not venture to answer is, "Does carcinoma of the upper gums occur at a slightly older age than that of the lower gums, and if this is true, does such a factor influence the outcome favorably?"

Location.—Realizing the difficulties of giving the exact limitations and boundaries according to location, as lower gum, floor of mouth, tongue, and cheek, one or more of these locations given being continuous with contiguous tissues, and realizing also that some of our carcinomas involve more than one part, for the sake of simplicity we have given only one location, where more than one part was involved, selecting in such cases the probable primary site.

With this in mind, our entire series of thirty cases, in all of which we have a record of the location, has been divided accordingly into:

A. Upper jaw, which includes three cases in which the antrum was involved; one, the roof of mouth, and four, the upper gum; a total of eight.

B. Lower jaw, which includes two lesions of the tongue; seven, of the floor of the mouth, and eleven of the lower gum; a total of twenty.

In those textbooks with which we are familiar, the frequency of carcinoma of the lip and tongue are emphasized not entirely but almost to the exclusion of carcinoma of other parts. Only a few articles on carcinoma of the mouth mention carcinoma of the gums: Ewing,[1] Bland-Sutton,[7] and Simmons.[8] Why such discrepancies with our findings?

6. Brofeldt, S. A.: Leukoplakia and Cancer of Lips, Arbeit. a. d. Pathol. Inst. d. Univ. Helsingfors, 5:34-109, 1927.

7. Bland-Sutton, J.: Tumors, Innocent and Malignant, Ed. 7, 1922.

The most probable explanation is that carcinoma as we have found it is not seen so frequently by the physician as by the dentist, and consequently has not had the recognition it deserves. Secondly, let us call attention to the increased frequency of the lower gum involvement as compared with the upper. Attention is called to this same fact in the lower lip as compared with the upper lip. We know of no scientific reason for this fact.

The pathologic classification is given according to type of cell and grade of differentiation (Broders[9]) in Table 3. Its value is chiefly prognostic and is discussed from that angle later under "outcome." One is impressed at the large number of squamous cell cases, all but two being such; however, this is as one would expect. The other two cases, one a salivary gland type case from the antrum, are also referred to later. The other, also an antrum case, involved the nasal epithelium.

TABLE 3.—PATHOLOGIC CLASSIFICATION

	Grade		Grade
1 Squamous	3	16 Squamous	3
2 Squamous	2	17 Squamous	1
3 Squamous	3	18 Squamous	1
4 Squamous	3	19 Squamous	1
5 Pseudostratified	3	20 Squamous	2
6 Squamous	1	21 Squamous	1
7 Squamous	2-3	22 Squamous	1
(Dr. Quick)	2¾	23 Squamous	1
8 Squamous	2	24 Squamous	3
9 Squamous	1-2	25 Squamous	1
10 Squamous	3	26 Squamous	2
11 Squamous	1	27 Salivary gland	1
12 Squamous	2	28 Squamous	2
13 Squamous	1	29 Squamous	3
14 Squamous	1	30 Squamous	2
15 Squamous	2		

8. Simmons, C. C.: Carcinoma of Buccal Mucous Membrane, Boston M. & S. J., 191: 1018 (Nov. 27) 1924; Cancer of the Mouth, Surg Gynec. & Obst., 43:377-382 (Sept.) 1926.

9. Broders, A. C.: Grading of Carcinoma, Minnesota M. J., 8:726-730 (Dec.) 1925.

EARLIEST HISTORY OF LESION

To us, the study of the earliest lesion found, or the preexisting condition present, is the most important of all—most important because it seems that were it possible to clearly visualize the entire development of cancer from its incipiency, the best opportunity for the knowledge of its cause or causes rests in such observations.

The literature probably has more references on this question than on any other, so that it will be necessary only to give a few of the more important. Chronic infection, in respect to the etiology of cancer, has been emphasized as: chronic irritation from jagged irregular teeth or various ill-fitting appliances leading to leukoplakia, squamous cell overgrowths, papillomas, ulcers, fissures or cracks; from tobacco or snuff, syphilis, chronic antrum infections and pyorrhea. Less frequently, attention has been called to the fact that "loosening of a tooth or failure of a tooth socket to heal following extraction, may be due to cancer and be one of its earliest signs."

Before presenting our own cases, it must be realized that there are obvious difficulties in differentiating a preexisting lesion from the earliest lesion of the carcinoma (the one often running into the other) and that on account of treading on particularly dangerous ground because of the possibility of most serious erroneous conclusions, we will choose each word that we write with the utmost care and with due deliberation and use the same care in regard to conclusions.

On fifteen of our cases, we have no record as to the earliest condition; on the other fifteen, or half of the cases, we have some information, an analysis of which follows:

The largest group by far, eight cases, gives a definite history of a relationship

TABLE 4.—EARLIEST HISTORY OF LESIONS

Fifteen cases, no record; fifteen cases, recorded

TEETH GROUP (EIGHT CASES)

Case 18. Roughness of cheek at site with rough tooth for ten weeks—"Mothers Salve" used.

Case 22. Rough tooth irritated tongue seven weeks ago; leukoplakia on other side.

—A—

Case 11. Teeth extracted fifty years ago with roots left in, retained roots corresponding to tumor area.

Case 19. Tooth crowned fifteen years previously, removal of crown revealing carcinoma of gum.

Case 23. Tooth extracted nine years ago; a month later "growth" in socket followed by applications of iodin and "quid" of tobacco.

—B—

Case 4. Teeth extracted in area where carcinoma is located, failure of gums to heal (six months).

Case 8. Tooth extracted in area where carcinoma is located, failure of gums to heal (three months).

Case 15. Teeth extracted in area where carcinoma is located, failure of gums to heal (two months).

ANTRUM GROUP (THREE CASES)

Case 5. Progressive enlargement of antrum of unknown duration.

Case 1. Six-year history of antrum infection; carcinoma duration, three months.

Case 27. Tooth infection with antrum trouble, one year.

MISCELLANEOUS GROUP (FOUR CASES)

Case 9. Carcinoma of floor, one year's duration with fissures beneath tongue of unknown duration found.

Case 17. Carcinoma of gum giving a history of a fall three weeks previously; subsequent "abscess formation" and finding of fracture in region of carcinoma.

Case 21. Carcinoma of cheek with previously treated leukoplakia in this area which has been treated for five months; leukoplakia on opposite side of mouth.

Case 24. Carcinoma of floor, started as painless nodule underneath tongue.

of one or more teeth to the location of the carcinoma.

Two of these eight, we can dispose of quickly. Case 18 was a cancer of the cheek of ten weeks' duration, which the patient described as having started with a roughening of the inside of the cheek, the roughened and carcinomatous area corresponding with the rough surface of the tooth. Case 22, a cancer of the tongue of ten weeks' duration, according to the patient, started as an irritation from a rough tooth, which was subsequently extracted.

Six cancers of the gum give a similar but less definite story. In Case 11, the teeth were extracted fifty years ago, the roots left in, the retained roots corresponding to the tumor area. In Case 19, a tooth "crowned" fifteen years previously, removal of the crown revealed carcinoma of gum. In Case 23, a tooth extracted nine years previously, a month later showed a "growth" in the socket, which was "treated" by applications of iodin and a "quid" of tobacco. Cases 4, 8, and 15 all give a history of extraction, with failure of healing.

The next largest group is three cases, all of which show involvement of the antrum. Case 5 gives only a very indefinite history of a progressive enlargement of unknown duration. Cases 1 and 27 give definite histories of infection of six years' and of one year's duration. The first case was primarily that of an antrum infection. The other case, while also showing an antrum infection, shows likewise a history of tooth infection in the vicinity, the tooth having been removed, so that it seems impossible to state which infection was primary.

The remaining four cases of this group give different histories, the essential points of which in respect to previous condition or primary lesion we will briefly

state: Case 9, carcinoma of floor of mouth, one year's duration, with fissures beneath tongue of unknown duration found; Case 17, carcinoma of gum giving a history of a fall three weeks previously, subsequent "abscess" formation and finding of fracture in region of carcinoma; Case 21, carcinoma of cheek giving a history of a previous leukoplakia in this area which has been treated for five months (patient also shows leukoplakia on opposite side of mouth); Case 24, carcinoma of floor of mouth (patient says that the condition started as a small painless nodule underneath the tongue).

In the foregoing analysis, we have attempted without comment to present in brief but comprehensive form in a fair manner only such knowledge of the earliest lesion or prior condition present as is available to us from a study of our cases. Other factors which possibly modify or influence the earliest lesion, such as syphilis or use of alcohol or tobacco, we have purposely omitted in the summary of the cases just given. In the discussion which we are about to make some of these factors may be referred to.

Let us now compare our results with modern teachings and briefly discuss them.

In our small series of fifteen available histories, it is exceedingly interesting to note that over half, eight cases, give a history of a relationship to a tooth or teeth. The two Cases, 18 and 22, both of which apparently started in relationship to a roughened tooth, need no further comment at this time, except to emphasize that such a story is in keeping with accepted teaching. Of the other six cases, we have two equal groups: three Group A, Cases 11, 19, and 23, all of which antedate the carcinoma by extraction or crowning, fifty, fifteen and nine years, respectively, prior to the time of examination; and three Group B, Cases 4, 8 and 15, all of which give a history of tooth extraction with subsequent failure of healing, and all of which date (?) the carcinoma from the time of tooth extraction.

While these two groups present fairly typical stories, but one question of importance arises: Was the carcinoma the primary condition responsible for the trouble with the teeth and their subsequent removal? Or was a previous noncancerous condition a predisposing factor in the development of the carcinoma? In Group B, we think it is apparent that carcinoma was most likely there first, when we consider that they all date the carcinomas from the time of tooth removal and these findings are in keeping with independent statements made by Simmons[8] (first reference) and Pichler,[10] that loosening of a tooth or failure of a tooth socket to heal after extraction may be due to cancer and one of its earliest signs. Are not these three cases also evidence that carcinoma may develop on a previously healthy soil?

In Group A, it is apparent that a previous noncancerous condition was a predisposing factor in the etiology of carcinoma. (This group as well as the first two cases mentioned indicate some prior local chronic irritation.)

The second largest group under this heading, all antrum cases, have previously been described, and no further remarks are called for, except to say that attention has been called to antrum carcinoma by Ewing[1] and Bland-Sutton,[7] and also that chronic irritation is not to be denied in these cases.

10. Pichler, Hans: When Should the Practitioner Think of Neoformations in the Oral Cavity and Which Diagnostic Expedients Are at His Disposal? Wien. klin. Wchnschr., 39:307-308 (March 11) 1926.

Of the various factors mentioned in the literature on the subject, leukoplakia has been particularly emphasized as a potential precancerous lesion. Fournier, referred to in Ewing's[1] authoritative textbook on tumors, is quoted as having claimed that 30 per cent of his series of cancers of the tongue are preceded by leukoplakia. Bergman, in 159 cases of cancer of the tongue, found that 34.6 per cent showed a preceding leukoplakia. Many other authorities or writers particularly stress leukoplakia in this respect and especially, according to Schmidt,[5] that type of leukoplakia which tends to be unduly thickened and ulcerated. Jacobson, in Ewing,[1] considers leukoplakia as precancerous, especially when warts appear. But two of our cases are recorded as showing leukoplakia at the time of the first examination: Case 21, carcinoma of the cheek; and Case 22, carcinoma of the tongue. In the first case, leukoplakia was present in both cheeks, the one cheek showing cancer following a leukoplakia which received local treatment. In the second case, the leukoplakia patch was on the tongue but not in the carcinoma area. Considering the fact that we do not have a complete record of these thirty cases as to the presence or absence, or exact location and time of development, of the leukoplakia in relationship to the carcinoma, any statements concerning this condition and its relationship to cancer may be interpreted as speculation. Coupled with the knowledge of the general teachings as to leukoplakia and based upon our own findings, the following points in this respect may be suggested. If leukoplakia is so frequently a precancerous lesion, as emphasis in general teachings would lead us to believe, considering the number of cases of leukoplakia that we see compared to the number of carcinomas, we should see more cases of leukoplakia with carcinoma following than of carcinomas with leukoplakia preceding. It would seem that a distinction should be made as far as the etiology of carcinoma is concerned. Schmidt[5] called attention to those leukoplakia areas which are single, unduly chronic and tend to thicken and ulcerate. Secondly, there are leukoplakias which receive too much irritating treatment, as in Case 21. Case 23, while not a leukoplakia, also possibly received too much "irritating treatment."

Let us now consider squamous cell papillomas, although this study had no cases coming under this, as far as we know. A true squamous-cell papilloma is a squamous epithelial overgrowth, whose growth is primarily outward. We know from our studies of this type of growth in other parts of the body that such growths are without a doubt potentially carcinomatous. Our experience, as far as the mouth is concerned, is that such growths are not especially common. It is taught that fissures are precancerous (Brofeldt,[6] Clark [11] and McGuffin[12]). Case 9, cancer of the floor of the mouth, showed fissures beneath the tongue. Ill-fitting appliances in the mouth have previously been mentioned (Clark [11]). We have a record of one of our cases previously described, Case 19, which revealed a carcinoma of the gum after removal of a crown.

TOBACCO

Many references are made to the influence of tobacco in the direct form or by smoking, pipe smoking especially, but

11. Clark, W. L.: Treatment of Neoplastic Diseases of the Oral Cavity, with Histological Data, Dent. Cosmos, 66:1177 (Nov.) 1924.

12. McGuffin, W. H.: Cancer of Lower Lip, Canadian M. A. J., 15:1046-1049 (Oct.) 1925.

Broders[13] in his report of 537 patients with carcinoma of the lip finds that among the tobacco users and the non-users, the percentage was about the same. Ewing admits that the action of tobacco is not clearly understood, but states that the irritation so produced is a factor.

The relationship of tobacco to leukoplakia is well known (Ewing[14]).

TUBERCULOSIS AND SYPHILIS

Tuberculosis.—In respect to tuberculosis, we have little to say, and our one excuse for including it in this paper is an article by Finney and Finney[15] on tuberculosis of the tongue in which they report fifteen cases of tuberculosis of the tongue, in three of which operation was performed for carcinoma. We think that these cases demonstrate the value of a biopsy in doubtful cases of malignancy most strikingly.

While only sixteen patients were interrogated as to pain, it would seem that while pain may or may not be present in those cases in which the duration of the growth is shorter, pain is less likely to be present. Also it seems that in such locations as the floor of the mouth, tongue or cheek, pain is possibly more likely to be present.

Several references on pain which our few findings do not contradict are called to your attention.

"Early carcinoma shows no pain," (Simmons,[8] first reference). "Pain and looseness of teeth suggest carcinoma," (Simmons[8], first reference, and Pichler[11]). May we add, Is the pain due to the cancer or condition of the teeth? "Carcinoma of the lip of the infiltrating type causes pain," (McGuffin[12]). "In carcinoma of the tongue, the patients may complain of great suffering but this occurs late and may be influenced by treatment," (Gordon[16]). "In carcinoma of the antrum, the patient may complain of pain in the jaw sometimes spoken of

TABLE 5.—PAIN

Case		Location	Duration of Tumor
5	No pain or tenderness	Antrum	?
6	No pain	Lower gum	Three weeks
25	No pain	Lower gum	Two months
29	No pain or tenderness	S. gum	Two to three weeks
10	Painful only after extraction	Lower gum	One month
11	Pain over roots on mastication	S. gum	One and one-half months
19	Slight sensitivity over gums—pain on pressure	Gum	?
30	Pain on pressure	Lower gum	?
1	Very little pain	Antrum	Three months
18	Progressively more painful	Cheek	Two and one-half months
21	Moderate pain	Cheek	Five months
8	Tender—painful	Lower gum	Three months
20	Pain severe	Floor	Two years
22	Pain only past week	Tongue	Two months
23	Painful as growth progressed	Gum	?
24	Pain radiating to ear	Floor	Two months

13. Broders, A. C.: Squamous Cell Epithelioma of Lip, J. A. M. A., 74:656 (March 6), 1920.

14. Ewing, James: Prevention of Cancer, Surg. Gynec. & Obst., 44:167 (May) 1927.

15. Finney, J. M. T., and Finney, J. M. T., Jr.: Tuberculosis of Tongue, Surg., Gynec. & Obst., 40:743-750 (June) 1925.

16. Gordon, T. E.: Cancer of the Tongue, Irish J. M. Sci., Sixth Series, pp. 258-260 (June) 1927.

as neuralgia, for which no adequate cause can be assigned," (Bland-Sutton[7]).

Our records, while incomplete, apparently give about an even proportion of those cases showing a loss of weight. How much influence time may be, we cannot say.

The two cheek cases show a marked loss of weight. (Both of the patients had a four plus Wassermann reaction.)

While tuberculosis may present similarities clinically to carcinoma at times, the possibility of the two conditions being associated must be borne in mind.

While we realize the possibilities of giant-cell formation in epithelioma as was so ably shown by Forbes,[17] one of our cases (8) showed microscopically tuberculosis in association with carcinoma.

TABLE 6.—LOSS OF WEIGHT (AT TIME OF FIRST OBSERVATION)

Case	Location	Condition
8	Lower gum	Loss of weight
18	Cheek	Loss of 45 pounds in five months
20	Floor	Has been losing weight gradually
21	Cheek	Loss of 20 pounds in five months
24	Lower gum	Slight loss of weight
19	Lower gum	No loss of weight
22	Tongue	No loss of weight
23	Lower gum	No loss of weight
25	Lower gum	No loss of weight

Syphilis.—Our records concerning syphilis are decidedly incomplete; but in view of the fact that much of importance relative to syphilis in relationship to leukoplakia and carcinoma has been written, it seems wise to speak of this subject.

We have records on only six cases relating to syphilis; one patient denied infection; one had a negative Wassermann reaction, one gave a history of syphilis forty-three years previously, and three have a four plus Wassermann reaction.

How high the incidence of syphilis in our cases would have been, if our histories had been complete and if we had made Wassermann tests in all of them, cannot be said, but even with our incomplete figures, we found at least 13 per cent.

Figures of seven in 210 (Meller), 155 in 184 (Fournier), according to Ewing,[1] are given for the incidence of syphilis in buccal carcinoma; while Brofeldt,[6] in his report on a histologic study of twenty-five cases of leukoplakia and twenty-six of carcinoma of the lips, had none with positive Wassermann reactions or other evidences of syphilis.

While the relation of leukoplakia to syphilis and either of these two conditions to carcinoma has been frequently cited, it is said (Ewing[1]) that for syphilis the action seems to be indirect.

Histologic studies of the local lesions of our cases revealed no characteristic evidences of syphilis.

It is important to bear in mind the frequent association of both conditions, as Semken[18] has emphasized, and the fact that an individual has one of these two conditions should not prevent a consideration that the other condition may be present.

A case report from Cabot[19] (Case 12073), in which because an individual had syphilis, the recognition of carcinoma was delayed for some time, is similar to our Case 18.

Loss of weight depends principally on interference with nutrition. In cancer, loss of weight will occur in those cases where interference with nutrition is greatest, as carcinoma of the stomach, in contrast to that of the breast. Location,

17. Forbes, A.: Origin and Development of Giant Cells in an Epidermoid Carcinoma of Tongue, J. M. Res., 23, (Aug.) 1910-1911.

18. Semken, G. H.: Cancer as a Specialty, Surg. Gynec. & Obst., 44, (May) 1927.

19. Cabot Case Records, Case 12073, Boston M. & S. J., 194:311-314 (Feb. 18) 1926.

therefore, is an important determining factor and must be considered in reference to loss of weight.

The few cases recorded as showing lymph gland enlargement are all in the lower jaw. One would naturally expect this and attention has frequently been called to this, as noted by Semken.[18]

Boyd[4] has called attention to interesting and important observations relative to lymph gland enlargement; quoting a study of lymph glands in carcinoma of the lip made by Dudgeon and Mitchener in which they found that, in the presence of enlarged glands in early cases, 37 per cent showed carcinoma involvement, while late cases showed 50 per cent involvement. Also, Simmons[8] (second reference) in his report on cancer of the mouth, reports palpable lymph glands in sixteen cases, nine of which proved not to be cancer, and nine cases of nonpalpable lymph glands, two of which were cancerous.

TABLE 7.—LYMPH GLAND ENLARGEMENT

Case	Location	Condition
9	Floor	Swelling of right submaxillary gland
12	Tongue	Adenitis
20	Floor	Slight enlargement of lymph glands
22	Tongue	Submaxillary glands both sides
18	Cheek	No glands noted
19	Lower gum	No glands noted
21	Cheek	No glands noted

It is to be concluded that lymph glands may be enlarged in carcinoma, and this enlargement may be metastatic or may be inflammatory. The later the case, the more likely is carcinoma to be present. Lastly, lymph glands may show cancer and not be palpable.

OUTCOME

While there are many factors influencing the ultimate behavior or outcome of these cases, before presenting our final chart as to outcome and giving brief consideration to the more important factors, we will study the record of the age of the lesion at the time of the first observation and discuss this important subject in its relation to outcome.

While we realize that basing our answers to this question on information furnished by the patient may not be accurate, obviously we have no alternative.

One is impressed, we think, at the relatively short "duration" of these cases prior to time of examination. While five are a year or more old, the remainder are a question of months, six or less. This short duration is undoubtedly due to the fact that these cases are "dental" rather than "medical" cases. We mean that the older the condition, the more numerous the symptoms, and the greater the probability that medical rather than dental advice would have been sought.

TABLE 8.—AGE OF LESION AT THE TIME OF THE FIRST OBSERVATION

Case	Months	Case	Months
1	3+	16	6
2	2	17	¾
3	?	18	2½
4	6	19	?
5	?	20	24
6	¾	21	5
7	4	22	2
8	3	23	108 ?
9	12	24	11
10	1	25	2
11	1½	26	4
12	1	27	12
13	¾	28	3
14	12	29	¾
15	2	30	No record

This also we think is further evidence of the great responsibility of the dentist. If these cases are to be successfully treated, the earlier they are seen and recognized and proper treatment is instituted, the better it will be. Therefore, in this type of case, the dentist will have to do his share.

Case 23, giving a nine-year history, is undoubtedly not of nine years' duration. A summary of his history follows:

A man, aged 60, had had a molar extracted nine years previously. A month later, a growth developed in the socket. Applications of iodin were made. The patient chewed tobacco, carrying the quid at this site. He ceased chewing believing it the cause of growth of the tumor.

At what period during the nine years cancer developed cannot be said, but the original growth in the socket was probably granulation tissue following which there was much "irritation."

Of great interest in respect to duration is the question as to whether or not the time of duration prior to the time of treatment is of prognostic value. While as a general rule it is apparent that the shorter time a growth has been present, the less extensive the growth will be and the more easily removed, we must also remember that, at times, the fact that a growth has been present a long time may be due to the fact that it is a particularly slow growing tumor and thereby may be "most amenable to treatment." Simmons[8] (second reference) suggests this last explanation in view of the fact that the duration in his cured cases was distinctly longer than the average. The converse of this must not be lost sight of. This condition is frequently seen in scirrhous carcinoma of the breast where a small hard slow-growing tumor is not recognized until the lymph nodes have long since been invaded.

TABLE 9.—OUTCOME

Case	Age	Location	Grade	Notes	Age of Lesion at First Observation Months	Age of Lesion at Last Observation Months
1 Dr. C.	31	Antrum	3	Dead	3	12
5 Dr. W.	80	Antrum	3	Dead	?	?
8	52	L. Gum	2	Died immediately (postoperative)	3	3
13 Dr. K.	67	S. Gum	1	Dead	¾	13
16 Dr. K.	45	Roof	3	Dead	6	25
20 Dr. P.	68	Floor	2	Worse, rapid progression	24	26
21 Dr. K.	36	Cheek	1	Worse, recurrence on lip	5	22
24 Dr. K.	57	Floor	3	Worse	11	18
25 Dr. K.	65	L. Gum	1	Worse	4	6
28 Dr. K.	76	Floor	2	Worse, recurrence on chin	3	7
10 Dr. K.	52	L. Gum	3	Treated but did not return	1	13
11 Dr. K.	84	S. Gum	1	Treated but did not return	1½	1½
12 Dr. K.	44	Tongue	2	Treated but did not return	1	2
19 Dr. K.	45	L. Gum	1	Treated but did not return	?	?
7 Dr. Q.	69	L. Gum	2-3	Progress favorable	4	19
26 Dr. K.	65	Floor	2	Improved	4	10
27 Dr. K.	28	Antrum	1	Alive and well	12	18

From the following "followup chart," nothing can be said in respect to this point.

Of the factors which influence the outcome, we will give brief consideration to the gross character of the growth, the microscopic type of the growth, the degree of cell differentiation, age of the patient, location, treatment and septicity of the lesion, and accidents.

1. *Gross Character of Growth.*—Our records do not give detailed data in respect to whether or not the growths

were infiltrative or papillary, but we feel justified in classing the bulk of these tumors as infiltrating and ulcerating in character. In comparing such characteristics, it is easily appreciated that the papillary growth, essentially an outward growth, is not only less destructive and serious, but also much more amenable to treatment.

2. *Microscopic Type of Growth.*—The type of growth is important in its influence on the outcome. Recalling our previous classification as to type: Twenty-eight of our cases were squamous, one was of the salivary gland type and one was a nasal epithelium.

It is a question whether the salivary gland type case should have been included in view of the fact that it is similar in behavior to the mixed tumor, the most common tumor of salivary glands. Whereas, the other twenty-nine cases, squamous and nasal epithelium, are all very definitely malignant, mixed tumors are essentially locally malignant, tending to recur if not thoroughly removed, but not tending to metastasize.

3. *Cell Differentiation.*—Great clinical value is given by some to this gradation. Broders' classification is based upon the long recognized micropathologic principles that the more a cell differentiates, the less malignant it is, and the more a cell varies from the normal (anaplasia), the more malignant it is. With these factors in mind, he classifies carcinoma in grades one, two, three and four, largely based upon the amount of differentiation the tumor shows; grade one being the least malignant and grade four the most malignant.

While our followup chart is too small and incomplete for us to draw any conclusions as to the merits of this classification, and while our findings are possibly in keeping with it, and we do not deny the value of a knowledge of the principles upon which it is based, it seems to us that too many other factors determine the malignancy of tumors. A most valuable contribution in respect to this point, the relation between the histologic picture and prognosis of tumors, is that of Alfred Plaut.[20] Also, a very recent article on carcinoma of the breast by Lee and Stubenbord[21] calls attention to the extreme importance of considering the clinical factors rather than the grade of cancer in the prognosis of these cases. The other factors influencing the ultimate behavior of growths are decidedly more important.

4. *Age of Patient.*—Let us take this opportunity to stress a point relative to age that is generally accepted and taught, a point that, from our experience, does not get the clinical recognition and most important application it deserves, namely, that, taking into consideration all such factors that influence the relative malignancy of any malignant tumor as mentioned above, age is one of the most important. The older an individual, the less malignant the growth, and its converse is equally true, or even truer: the younger an individual, the more malignant the lesion.

In our previous remarks, on age, attention was called to the fact that almost all of our patients were well past middle life. The three youngest patients we had have all been followed up. The youngest (Case 27), aged 28, is alive and well, but when we consider the type of growth, this is not surprising; the two next youngest (Case 1), aged 31, and (Case 21),

20. Plaut, A.: Relation Between Histologic Picture and Prognosis of Tumors, Arch. Path. Lab. Med., 3:240 (Feb.) 1927.

21. Lee, B. J., and Stubenbord, J. G.: Clinical Index of Malignancy for Carcinoma of Breast, Bull. New York Acad. Med., February, 1929.

aged 36, turned out poorly. One died twelve months after onset, and the other is worse, with a recurrence twenty-two months after onset. In Case 16, the patient, aged 45, died twenty-five months after onset.

5. *Location.*—Little will be said relative to location in respect to outcome. Our own records are too small and incomplete for any comment. With Simmons[8] (second reference), the cases involving the tongue, floor and lower gums have been more malignant than those of the upper jaw, while the least malignant have been those of the cheek.

6. *Treatment.*—It is not within the providence of this paper to discuss treatment. In view of the fact that we cannot compare treated and untreated cases, not only can nothing in respect to this be said except that we have three cases showing improvement, but it is also of interest to note that many of these patients have lived for relatively long periods of time since they were referred for treatment. We note this not only with interest but also with decided encouragement when we stop to consider the fact that the average duration of life in these cases (in cancer of the tongue and lip mostly) is given by Gordon as eighteen months. According to Ewing,[1] they terminate fatally in an average of two years. Bland-Sutton's terminate fatally from six to twenty-four months after recognition. Undoubtedly, then, the lives of many of these cases can be prolonged by treatment, and not only that, but early cases can be cured. (Simmons,[8] Bloodgood,[2] Clark.[11])

7. *Septicity.*—We can give little information as to the degree of septicity in our cases, but undoubtedly this is another important factor. Various writers, such as Bland-Sutton,[7] have called attention to this. While secondary infection in these cases in the mouth is particularly liable to occur, we know that some cases show it more than others, and in those cases with such infection, the outcome is less favorable. The factors probably responsible for this are more rapid and extensive local growth, more absorption (toxemia) and a more marked tendency to accidents or complications such as hemorrhage.

8. *Accidents.*—It is a question as to just what should be considered as accidents in these cases. If operation is performed in a case of this type and the patient dies immediately, as in Case 8, it is an accident and obviously not fair to consider death as due to the cancer. If, during the course of the disease, the patient has hemorrhages from the carcinoma, such hemorrhages being responsible for his death, while we may have to look on the hemorrhages as accidents, death must be regarded as due to the cancer. In the same way, the most frequent outcome in these cases is death by "pneumonia, septicemia and hemorrhage" (Ewing[1]), conditions which, while regarded as accidents, should be looked on as due to the cancer.

Since the preparation of this paper, we have received a communication from William S. Stone of Memorial Hospital, whom we wish to thank, in which he gives us further followup data on one old case and three new cases; which increases our "follow-up" to twenty. This information follows in Table 10.

These findings substantiate further our previous remarks.

BIOPSY

In estimating the value of any procedure, we must weigh any possible disadvantages with its advantages.

On the side of disadvantages, there are only two factors worthy of consideration: hemorrhage and pain, and, second and most important, dissemination of the car-

cinoma. While we know that many of these growths may bleed easily, and realize at times that such a procedure may be painful, we are not familiar with any case in which a hemorrhage of any significance followed the making of a biopsy.

Concerning dissemination of the carcinoma, it seems that this is more to be considered theoretically than practically. From practical experience, we are familiar with the dangers attendant on irritation of pigmented moles (melanin tumors), but these tumors do not occur in the mouth.

While others as well as McGuffin[12] say "Do not perform a biopsy," and while we know, as Semken[17] says, that too much manipulation is dangerous, the dangers of a biopsy seem no greater than traumatism in undue handling of the tumor or other forms of excess trauma.

The weight of authority is unquestionably in favor of such a procedure as is exemplified by statements of such men as Ewing[1]: "Do a biopsy;" Bland-Sutton[7]: "Remove a piece;" Boyd[4]: "When in doubt, remove a piece."

The value of actually establishing the diagnosis is obvious.

The limits of a biopsy must also be called to your attention. How often is the pathologist unjustly censured for missing a malignant growth when a second section proves the case? Case 10 is illustrative of this, the first biopsy revealing only infected tissue. In explaining this, as well as in making a biopsy, we must not forget that these misleading reports may be due to the fact that the specimen was too small for complete diagnosis, or the specimen was taken from an area adjacent to the area of malignancy, or that the inflammatory reaction so often accompanying the tumor may mask the malignancy.

TABLE 10.—OUTCOME

Case	Age	Location	Grade	Notes	Age of Lesion at First Observation Months	Age of Lesion at Last Observation Months
7*	69	L. gum	1	Dead	4	24
9	63	Floor	1-2	Condition fair	12	44
18	40	Cheek	1	Dead	2½	14
29	69	S. gum	3	Is being treated	¾	3

*Also in Table 1.

SUMMARY

A group of questions relating to "Cancer of the Mouth from a Dental Standpoint" is answered by a study of thirty cases and a comparison with teachings in which the following points are brought forth:

1. Cancer of the mouth is not only a great problem, but also part of the solution possibly rests with the dental profession.

2. Cancer of the mouth should be the same to the dentist that cancer of the breast and the uterus are to the physician.

3. Cancer is frequent; is not related to epulis; is found in white males, especially from 40 to 60 years of age, and is found not only on lip or tongue but also and especially on the lower gums and floor of the mouth. They are of squamous type.

4. In the history of the earliest lesion, a history of relationship to a tooth is more frequent than leukoplakia or other forms of chronic irritation. Failure of a tooth socket to heal or the presence of a

single ulcerated area of leukoplakia or "treated" leukoplakia deserves special consideration.

5. While syphilis may be a factor, the association of the two conditions must be borne in mind.

6. While pain and loss of weight may occur, they are not important, and lymph gland enlargement does not necessarily mean metastases.

7. Many factors influence outcome, such as type of growth, age of patient and duration of growth. The grade of malignancy *per se* means little.

8. Biopsies should be made, especially before radical surgery is attempted.

CONCLUSIONS

We regret the incompleteness of our records. For some time, we have felt so chagrined over their many deficiencies that we reluctantly undertook publication of this study. It seems, as we have progressed with this work that our records and material are of value (directly valuable in proportion to their accuracy and completeness, we must admit), but a study of them may throw some light on the question of cancer of the mouth as seen by the dentist; and perhaps this contribution will not have been in vain, if it but serves to show us not only how much better it might have been, had our records been complete, but also how valuable and indispensable complete data are in any study of this kind. Also perhaps it may serve to stimulate future research of this type, a type of research which requires no expensive equipment or experimental laboratory, and which needs to be done if dentistry is to reach the place we desire for it.

The authors wish to thank Dr. Alexander Fraser, Chief of the pathologic department of New York University (from which department this study is presented) not only for his kindness and encouragement but also for many valuable suggestions and assistance in the preparation of this work.

They acknowledge indebtedness to Dr. Ira Kaplan, chief of the Bellevue Hospital Radium Therapy Department, not only for his courtesy but for his cooperation in giving them most of the information upon which Table 9 is based. They wish also to acknowledge indebtedness to Dr. Winter, Dr. Cipes of Mt. Vernon, Dr. Quick of Memorial Hospital, and Dr. Price of Welfare Island.

PRINCIPLES EMPLOYED IN FULL DENTURE PROSTHESIS WHICH MAY BE APPLIED IN OTHER FIELDS OF DENTISTRY*

By CLYDE H. SCHUYLER, D. D. S., New York City

MANY of the principles of occlusion have been first recognized and generally applied by the full denture workers, not because of any superior powers, but because the teeth, and consequently the tooth guidances, may so easily be arranged to various positions. Furthermore, the results of inharmonious guidances can be more easily and quickly seen with denture bases resting upon insecure foundations.

*Read before the Section on Full Denture Prosthesis at the Seventieth Annual Session of the American Dental Association, Minneapolis, Minn., Aug. 23, 1928.

This does not mean that all principles of occlusion pertaining to full denture prosthesis are applicable to the natural dentition, nor that it would be possible to obtain in other branches of dentistry the same degree of perfection in occlusal relations as may be produced in full denture restorations. While such perfection might be desirable, it is not altogether essential to the health and maintenance of the supporting structures of the natural dentition.

There are principles which, if better comprehended, would be an aid to the denture prosthetist, and which should be given consideration in all branches of restorative and corrective dentistry.

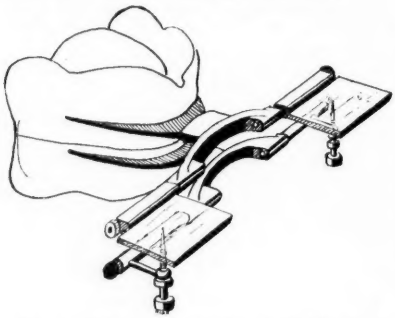

Fig. 1.—Means of securing a double check on all the relations of the mandible to the maxilla as advocated by Victor H. Sears.

To obviate a possible misunderstanding, let us first give our interpretation of a few terms which we may employ.

The term "balanced occlusions" is most applicable to restorations supported by the soft tissue. It is defined by Sears[1] as "contact positions of masticatory surfaces, having contact points so distributed that the forces simultaneously applied to these points of the denture, will maintain equilibrium."

1. Sears, V. H.: Balanced Occlusion, J.A.D.A., 12:1448 (Dec.) 1925.

Ottolengui[2] has given us the term "functional occlusion" in preference to "balanced occlusion" when speaking of the natural dentition, as "such arrangement of the teeth as will provide the highest efficiency during all the excursions of the mandible which are necessary to the function of mastication."

McCall and Stillman[3] have defined "traumatic occlusion" as "an abnormal occlusal stress which is capable of producing, or has produced, an injury to the periodontium."

The first necessity for a balanced and innocuous occlusal relation for all teeth, natural or not, is harmony between centric relation and centric occlusion. Centric relation has been accepted as "the most retruded rest position of the mandible from which lateral movement can be made." (Sears.[4]) Centric occlusion is the contact position of opposing masticatory surfaces to which other occlusions such as lateral and protrusive are referred. It is most often a static position of the opposing occlusal surfaces under normal pressure.

The careful prosthodontist is cognizant of the ills produced when the teeth of the full artificial denture have been articulated to occlude with the mandible in a protruded, or lateral, relation. It is associated with instability of bases, irritation to the supporting tissues and absorption to the alveolar ridges.

Even though an adjustable articulator has been used, the teeth have been artic-

2. Ottolengui, R.: Functional Occlusion, Dent. Items Int., 50:60 (Jan.) 1928.

3. McCall, J. O.: Dent. Items Int., 48:342 (May) 1926. Stillman, P. R.: Dent. Items Int., 48:358 (May) 1926.

4. Sears, V. H.: Jaw Relations and Articulator Adjustments, Dent. Cosmos, 68:1047 (Nov.) 1926.

ulated with unlimited care and the work has been completed by the usual milling process, if correct occlusion in centric relation has not been obtained, the finished denture, if used, will not give the maximum in efficiency, with the minimum of trauma. It has been recognized by many of our leading prosthodontists as one of the most important factors, if not the most important factor, in full denture construction, yet that portion of the work which is often inaccurate.[5]

strument, unaided by mechanical devices. This is most often the opinion of the man who has made insufficient checks to realize the extent of his errors.

The needle point tracer in its many forms has been commonly used in full denture prothesis. Points have been inserted in the occlusal rims, or externally to them, in such a way as to trace the movements of the mandible as it moves from the centric to the eccentric relations. The lateral movements of the mandible produce tracings in the form

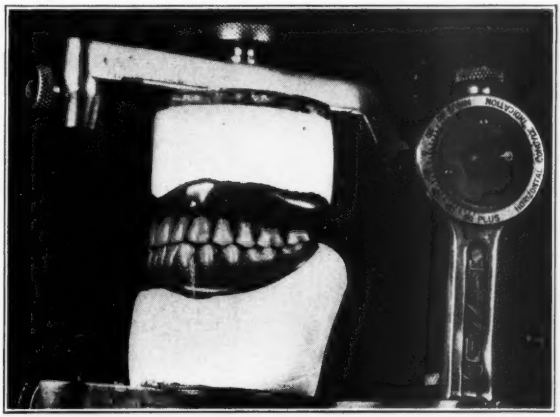

Fig. 2.—Disharmony between centric relation and centric occlusion, the result of the settling of denture bases and the consequent closing of the maxillomandibular relations, the mandible rotating around the intercondylar axis.

There are two recognized methods of establishing centric relation, yet few practitioners avail themselves of any definite control. Many recognize the importance of the definite control, but have confidence in their ability to transfer bite-plates in this relation, to an in-

of an arrow point, first recognized by Balkwill.[6] The apex of this arch or arrow point marks the rest position of the mandible.

Sears later designed a double tracer as a more definite means of securing centric relation records. (Fig. 1.)

When the needle point is mounted to the maxillary jaw, its tracing resembles

5. Wright, W. H.: Some Observations of Jaw Relationship to be Considered During Full Denture Construction, J.N.D.A., 9:209 (March) 1922.

6. Balkwill, F. H.: Odontological Society of Great Britain, June 4, 1866.

a Gothic arch. A practical tracing device was devised by Gysi,[7] and the tracing obtained by this technic has come to be known as the Gysi gothic arch. The ability to retrude from this rest position is noticed in a very limited number of cases. It is probable that this retrusion occurs only when the maxillomandibular relation has been opened more than to the accustomed position, this bringing the heads of the condyles slightly forward in their sockets.

A disharmony in centric occlusion of the artificial full denture is often caused by the settling of the denture bases to

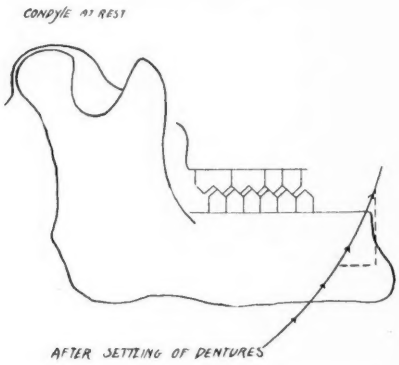

Fig. 3.—Disharmony between centric relation and centric occlusion, the result of the settling of denture bases and the consequent closing of the maxillomandibular relations, the mandible rotating around the intercondylar axis.

the tissues, or by alveolar absorption. (Figs. 2-3.) In such a closing of the bite, the mandible moves forward, rotating around the intercondylar axis. Thus, a position of the condyle heads slightly anterior to their rest position might be an advantage in maintaining occlusal harmony, if the gradual muscular relaxation allowing the condyle to assume its rest position would compensate for forward movement of the mandibular teeth with the settling of the denture bases.

In cases in which the alveolar ridges are covered with thick, spongy gum, practically insuring a considerable settling of the bases immediately after the insertion of the dentures, and when interlocking cusps are used, it is advisable to articulate the teeth with the mandible

Fig. 4.—The Hickok bite-check as a means of securing centric relation in cases in which the presence of teeth would contraindicate the use of the arrowpoint tracer.

a millimeter or so anterior to its rest position, to avoid the necessity of subsequent cusp mutilation to prevent trauma. This position should be obtained by first mounting the casts in centric relation, after which the desired protrusion is obtained on the articulator. This precaution is not essential when channel teeth

7. Gysi, Alfred: Dent. Cosmos, 62:1 (Jan.) 1910. Practical Application of Research Results in Denture Construction, J. A. D. A., 16:199 (Feb.) 1929.

are used, as a slight change in anteroposterior relation does not produce the same ill results.[8]

Owing to the possible changes which may gradually take place in the occlusion, because of settling or the adjustment of the denture to the tissues, it is desirable to defer the final milling until after the dentures have been worn several days. In making the centric relation record, for the purpose of mounting dentures on the articulator, it is important to remember that only the smallest amount of interposed wax should be used, the opposing teeth being allowed to come almost, but not quite, into contact.

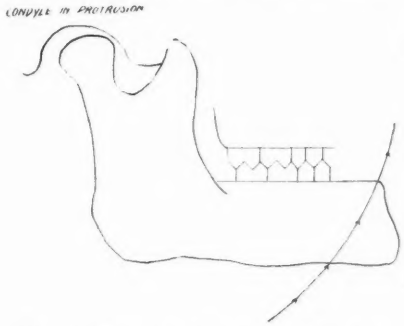

Fig. 5.—Teeth in centric occlusion with the mandible in a protruded relation to the maxilla.

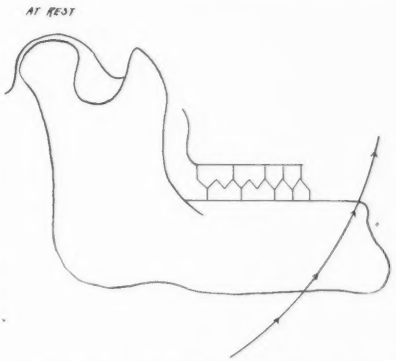

Fig. 6.—Centric occlusion in harmony with the centric maxillomandibular relation, the ideal condition, a means of avoiding unnecessary stresses to the structures supporting the teeth.

While the arrow point tracer is a practical device for checking centric relation when lateral tracings are made on smooth occlusal rims of denture bases, it is not so applicable after the teeth have been placed on the bases. Neither is it so serviceable in the securing of centric relation in any other branch of dentistry, such as partial denture construction, crowns and bridgework, periodontia and orthodontia. Here, the opening of the maxillomandibular relation sufficiently to insert smooth opposing surfaces to secure the tracing would lead to possible error.

The retractor, such as the Hickok bite-check (Fig. 4), has proved more serviceable for this purpose. With definite pressure placed on the chin, directing an equalized tension toward each condylar fossa, centric relation can, by means of this device, be obtained with the minimum amount of maxillomandibular separation. No occluding cusps should be in contact.

Centric relation is as important in the construction of partial dentures and bridges, the opening of the maxillomandibular relation by restorative dentistry or the relief of traumatic occlusion as in full denture construction. A disharmony between centric relation and centric occlusion is a form of malocclusion, capable of producing destruction of the alveolar tissues, supporting the natural

8. Sears, V. H.: Some Fundamental Factors in Tooth Articulations, J.D.R., 8:339 (June) 1928.

teeth as well as the artificial. It is too frequently disregarded. (Fig. 5.)

Before any partial restorative work is started, the remaining teeth should be placed in the most favorable occlusal relations. (Fig. 6.)

Occlusal wear, which is common with the natural teeth or the loss of teeth, permitting change of position of the teeth remaining, may produce a disharmony between the centric maxillomandibular relation and centric occlusion. The wearing of the occlusal surfaces causes the mandible to assume a forward position in its relation to the maxillae as, during this change, the mandible rotates around the condyle heads as an axis. This anteroposterior change may be in

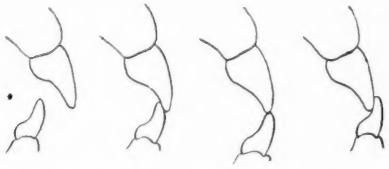

Fig. 7.—Relation of the anterior teeth or tooth guidance, which has a definite effect on tooth wear and may be a contributing factor in the production of disharmony between centric relation and centric occlusion.

harmony with the occlusal wear, yet the varying relations of the six anterior teeth, as the retrusive relation, the normal relation and the edge to edge relation, and in cases in which the lower teeth occlude anteriorly to the upper teeth, will influence different types of occlusal wear. (Fig. 7.) Individual habits of mastication, as unilateral chewing, or function on the anterior teeth, also are definite factors in occlusal wear. In the mouth, with the complete natural dentition, or in a partly edentulous condition, we may find centric occlusion associated with centric relation, or it may be associated with a protrusive or lateral relation. In rare cases, the normal anterior movement of the mandible, associated with occlusal wear, is restricted by the overbite of the anterior teeth, and, in some instances, as occlusal wear occurs, the mandible is forced posteriorly by the tooth guidances of the six anterior teeth to such a degree that a pathologic condition in the temporomandibular joint or a defect in the ear is produced.[9]

The correction of any existing disharmony between centric relation and centric occlusion should be the first step in the relief of malocclusion.

Any glide of the mandible from centric relation to a lateral or a protrusive relation as the teeth come into centric occlusion causes stresses which are not parallel with the long axes of the teeth, and is capable of dire results.

Before an effort is made to correct the occlusion in any case, casts with the teeth, preferably of metal, should be mounted on an adjustable instrument for study.

Centric relation should be established, not by occluding the casts but by making a centric relation record in the mouth, with a small layer of wax interposed; just sufficient to prevent cusp interference.

The anterior inclines of the cusps of the maxillary molars, or the posterior inclines of cusps of the mandibular molars, often cause interference. These interfering cusps should be ground down, if possible, without closing the maxillomandibular relation or creating a disbalance in the eccentric occlusions. In

9. Wright, W. H.: Deafness as Influenced by Malposition of the Jaws, J.N.D.A., 7:979 (Dec.) 1920.

many instances, trauma to the anterior teeth can be relieved by correcting inclined planes of the posterior teeth which cause the mandible to glide forward after tooth contact, thus making unnecessary the grinding of the anterior teeth.

The retractor, by tension, is a great aid to accuracy, not only in securing centric relation records but also in locating interfering cusps while relief is being made in the mouth as it retards the glide of the mandible, as cusp contact is made.

Many think that the retractor, which exerts approximately 3 pounds tension on each side of the mandible, toward the condyle head, would cause the mandible to assume a position behind its normal rest position. Owing to the nature of the tissues supporting the condyle, this does not seem probable. The use of the retractor on a large number of patients, checking centric relation in both edentulous cases and those with the full compliment of teeth without having obtained a relation that the patient did not accept as the normal rest position without tension, would seem to meet any objection on the ground of a forced relation.

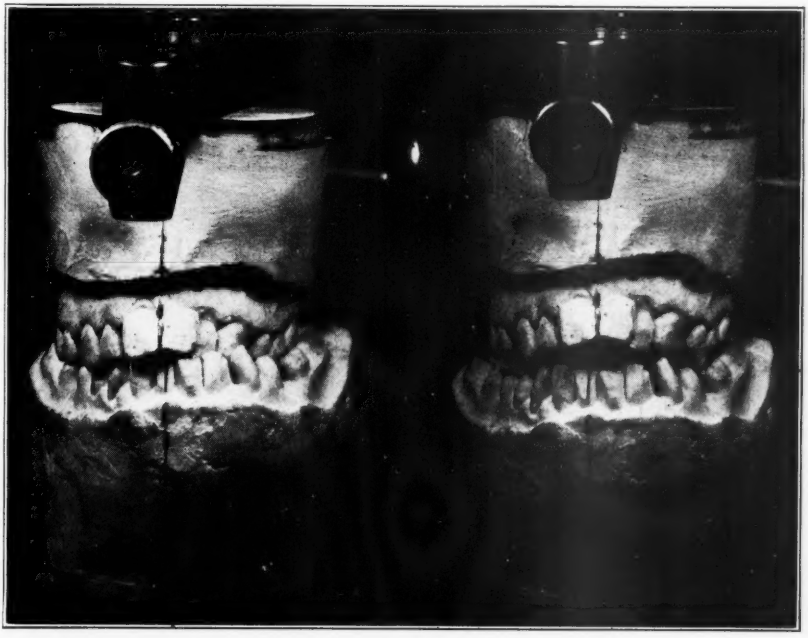

Fig. 8.—Disharmony between centric occlusion and the centric maxillomandibular relation in a girl, aged 18; centric occlusion associated with a lateral relation.

As a disharmony between centric relation and centric occlusion exists in many cases of malocclusion of young people (Fig. 8), it would seem that the extent of this disharmony should be determined by the mounting of study casts, as

previously mentioned, and by including in the orthodontist's malocclusion chart not only the direction and extent of tooth movement necessary to produce the desired arch form and occlusal relation, but the establishment of this harmony in centric maxillomandibular relation. It would seem that this coordination might eliminate much of the undesirable tooth movement following the removal of retaining appliances.

A disharmony between centric relation and centric occlusion often follows the opening of the maxillomandibular bite by partial dentures, crowns, bridges, or other forms of restorative work.

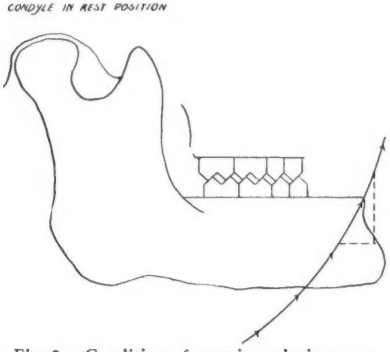

Fig. 9.—Condition of centric occlusion associated with a protruded relation, which is a common result of opening of maxillomandibular relations by restorative means such as onlays, bridge work or partial dentures supported primarily by natural teeth.

When the opening restorations are completed, the interdigitation of opposing cusps may appear ideal, but later, as muscular relaxation permits the readjustment of the maxillomandibular relation, trauma develops (Fig. 9), and the reforming of occlusal surfaces becomes necessary. This is not so difficult when the opening has been produced principally by removable restorations, but with any kind of fixed work, modification to relieve the occlusion usually results in flat, uncontoured restorations, which are not serviceable in the mastication of food without undue stress.

This may be attributed to the forward movement of the head of the condyle, associated with the opening of jaw relations. There are, perhaps, limits within which an opening can be made without the forward movement, but these limits are variable and there appears to be no way of predetermining them.

The mandible may be held by muscular tension in the forward position when records are taken. Soon after the inser-

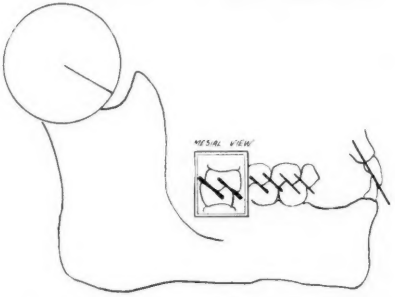

Fig. 10.—Effect of anterior tooth and condylar guidance on the wear of all tooth surfaces. Tooth cusps near the anterior tooth guidance will be influenced more by that guidance than by the condylar conditions, while the posterior teeth will more nearly similate the condylar guidance. All cusp surfaces mesial and distal, buccal and lingual should be in harmony with these guidances. Premature contact of a tooth surface can be relieved to eliminate trauma, but, for example, a change of anterior tooth guidance or a change of buccal lingual inclines of bicuspids and molars introduces trauma if all guiding surfaces are not made to harmonize.

tion of the denture, establishing the desired opening, muscular tension ceases, allowing the condyle heads again to as-

sume their rest positions in the glenoid fossae.

As mentioned previously, such a condition associated with a tissue-bearing appliance may, to an extent, be adjusted by tissue adaptation to the bases, but in dentures deriving support from the natural teeth, this settling does not occur, and the occlusion must therefore be modified by the dentist.

This change could perhaps be controlled in cases of limited opening by use of the retractor, or tension in the making of centric relation records.

In cases which necessitate a greater change in open relation or treatment due to disease, a temporary splint is indicated. This can be cast of gold and made removable, or cemented to position, or it can be made of vulcanite, but should have less definite cusp inclinations.

All forms of restorative or corrective work which might change tooth guidance should be planned, due thought being given to the stress or lack of stress which such changes will place on all remaining teeth. (Figs. 10-11.)

We have defined functional occlusion as "such arrangement of the teeth as will provide the highest efficiency during all excursions of the mandible which are necessary to the function of mastication." The term "highest efficiency" necessitates stresses being evenly distributed over the greatest number of teeth possible in that individual case.

The orthodontist cannot hope to move the teeth of his patients into the positions where they will function best and be in the least danger of suffering occlusal trauma, unless he knows in each case the centric relation of the jaws, and unless there is an innocuous distribution of stress in all eccentric relations.

The periodontist has greatly minimized occlusal trauma by the simple expedient of grinding away the tooth surfaces of too great prominence in order that the load on the teeth may be more evenly distributed, but unless the correct position of the mandible has first been determined, in centric relation, tooth surfaces may have been improperly or unnecessarily ground and a form of malocclusion will remain which may still cause havoc to the tooth investing tissues.

The crown and bridge worker who ignores centric relation, and who restores

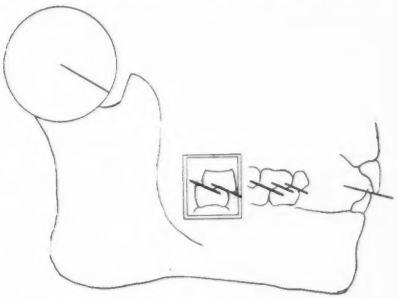

Fig. 11.—Effect of changing tooth guidances but maintaining harmony of these surfaces. In the opening of maxillomandibular relations by restorative dentistry, the anterior tooth guidance is made less steep, which necessitates flatter occlusal surfaces of bicuspids and molars.

teeth whose guidances or gliding facets do not face the articulating centers, as determined by the remaining teeth, unnecessarily sacrifices abutments and investing tissues of the opposing teeth. Even the filling which restores only a part of the occlusal surface must have its guidances so formed that they face in directions harmonious with the remaining occlusal and incisal surfaces.

The partial denture worker is confronted with the combined problems of the crown and bridge worker, the periodontist and the full denture prosthetist. Partial dentures are supported by the teeth, alveolar tissue or both, the health and preservation of which depends upon establishing and maintaining harmony between centric relation and centric occlusion, with an innocuous distribution of stresses in each eccentric position of the teeth.

Tooth contact on the balancing side of a partial denture should be approximately in the middle of the saddle area to maintain stability.

In fact, nearly every phase of dentistry is directly or indirectly dependent for its largest measure of success on obtaining the correct relation of the mandible to the maxilla and correctly arranging and forming tooth guidances.

These two outstanding principles, long recognized by leading full denture workers, should be adopted in other fields of dentistry.

The procedures employed in full denture prosthesis herein considered, or some modification of such procedures, should be mastered and consistently applied by all dentists.

THE BACTERIOLOGY OF DENTAL CARIES WITH SPECIAL REFERENCE TO BACILLUS ACIDOPHILUS*

By PHILIP JAY, D.D.S., and RALPH S. VOORHEES, Jr., D.D.S., Rochester, N. Y.

RESEARCH on the etiology of dental caries continues along two different avenues of approach. One group of investigators has advanced the theory that dental caries is a local manifestation of a more profound disturbance of metabolism. This condition is characterized by the inability of the body to assimilate properly those constituents of the food which are normally utilized to form and maintain the bones and teeth; or the organism may fail to select for itself a diet well fortified with these substances. On the other hand, dental caries is considered by some to be essentially a bacterial disease. Though the bacteriology of dental caries is not as yet entirely clear, it is apparent from recent work that certain aciduric organisms play a conspicuous part in the process.

The progress in dental bacteriology in general has been slow despite the fact that bacteria were first observed by Leeuwenhoek in the *materia alba* of the teeth. Among the various forms described by Leeuwenhoek was a long cylindrical, rigid rod. This particular type of organism, which we choose to call leptothrix, is as much a mystery to us today as it was to Leeuwenhoek over 200 years ago. Early investigators believed that the leptothrices bored directly into the enamel and by expansion due to normal physiologic

*From the Department of Bacteriology, School of Medicine and Dentistry, University of Rochester, and the Rochester Dental Dispensary.

*Read before the Research Session at the Sixth Annual Meeting of the American Association of Dental Schools, Chicago, Ill., March 26, 1929.

growth forced the rods apart, thereby initiating the process of dental caries. Leber and Rottenstein, in their treatise on dental caries, expressed the belief that these organisms were instrumental in the process by virtue of their ability "to glide through the dentinal tubuli." In summing up the more recent work, it seems more likely that the leptothrices are of primary importance in the formation of the bacterial plaques on the surface of the teeth. These organisms grow out into exceedingly long threads, which become intertwined and entangled, and also have a characteristic tendency to cling to apparently smooth surfaces. As the leptothrices grow on the surface of the enamel, the smaller and more potent acid-producing bacteria become enmeshed in their strands and are thus held in contact with the surface of the tooth. The cladothrices and streptothrices have also been considered factors in the plaque formation. Not all of the larger organisms seen in smears of the plaques are leptothrices. If, for instance, a number of specimens are carefully studied, one sees in many of them round or ovoid yeastlike bodies of the monilias which inhabit the mouth. The presence of these yeasts suggest that some of the filaments may be the mycelia of monilia. With this in mind, a series of early carious lesions were cultured, with the hope of demonstrating such filaments. The yeasts were easily isolated on casein digest sodium oleate agar and, when grown in pure culture, the mycelia were not unlike some of the large puzzling forms seen in smears.

Of more interest to us than the leptothrices and the monilias are the bacteria which are directly responsible for the decalcification of the enamel. In 1903, Goadby isolated an organism, which he named *Bacillus necrodentalis,* from carious dentin. At that time, Goadby attributed the decalcification of enamel and dentin to this bacillus, but, some years later, he changed his views and directed his attention toward certain of the streptococci. Kantorwicz and others supported Goadby's later views, and Hartzell and Henrici believed the *Streptococcus viridans* chiefly responsible for the disease. In 1915, Kligler reported that the streptococci predominated in caries-free mouths but that they apparently gave way to the bacillary forms in mouths afflicted with dental caries. He found particularly frequent in dental caries Moro's *Bacillus acidophilus,* which he considered to be the same as Goadby's *necrodentalis, Leptothrix buccalis, Cladothrix buccalis* and *Bacillus putrificus.*

Then followed studies by Howe, demonstrating the presence of one or both of the Moro-Tissier group, namely *Bacillus acidophilus* and *Bacillus bifidus* in all carious lesions of the teeth. Howe also identified his bacillus m, bacillus x and bacillus y with the process. It is definitely known that *Bacillus acidophilus* is pleomorphic and that one of its phases very closely resembles the m bacillus.

In 1922, there appeared publications, by Rodriguez in this country and McIntosh, James and Lazarus-Barlow in England, dealing with the occurrence of *Bacillus acidophilus* in dental caries. Working independently, the two groups arrived at similar conclusions, chiefly that *Bacillus acidophilus* could regularly be isolated from dental caries. These investigators were also able to produce caries experimentally *in vitro.* McIntosh recognized two main groups, *Bacillus acidophilus* Type 1 and *Bacillus acidophilus* Type 2. They could be distinguished morphologically since Type 2 is shorter than Type 1. Rodriguez sponsored types 1, 2, and 3. Types 1 and 3 were similar to 1 and 2 of McIntosh, while Type 2

of Rodriguez is not unlike Howe's bacillus m.

The following year, Clarke, working in England, isolated a streptococcus from dental caries and named it *Streptococcus mutans*. This organism appeared ordinarily as a streptococcus, but in an acid medium, which was somewhat inhibitory to its growth, it resembled more closely a bacillus. Clarke produced experimental caries *in vitro* with his organism also. This work was later confirmed by MacLean. It has been suggested that *Streptococcus mutans* is a form of *Bacillus acidophilus*. We had the opportunity of studying one of MacLean's strains of *Streptococcus mutans,* which unfortunately was no longer viable, but found that it differed morphologically from any acidophilus strain that had ever come to our attention. Recently, Abercrombie isolated a streptococcus from a case of infectious endocarditis believed to have originated from an infected tooth. This streptococcus was agglutinated by *Streptococcus mutans* serum and was believed by Abercrombie and Clarke to be a strain of *Streptococcus mutans*. Since *Bacillus acidophilus* is not pathogenic, these observations support Clarke's contention that *Streptococcus mutans* is a separate species.

Clarke further pointed out that McIntosh and others working with *Bacillus acidophilus* made their cultures under conditions not favorable for the growth of *Streptococcus mutans* as they employed an acid medium and took their cultures from the outer surface of the lesion. Clarke, on the other hand, took his cultures from within by splitting the tooth and approaching the lesion from the pulp chamber. In this fashion, Clarke and MacLean demonstrated that *Streptococcus mutans* penetrated more deeply into the dentin than did *Bacillus acidophilus*. This hardly indicates that the streptococcus surpasses the bacillus in etiologic importance. It is generally agreed that the bacteria themselves follow the influx of the acid which they produce. As the streptococcus is so much smaller than the bacillus, it might well be drawn up into the dentinal tubuli far in advance of the bacillus. The point to be borne in mind is that, in early carious lesions, *Bacillus acidophilus* overwhelmingly predominates.

In a series of reports published by Bunting since 1924, the views of Rodriguez and McIntosh were convincingly substantiated. During the past few years, Bunting has examined more than 1,000 individuals and found *Bacillus acidophilus* present in an exceedingly high percentage of dental caries. He found also that, in caries-free mouths, the organism was not to be found. Bunting produced caries experimentally *in vitro* with cultures of *B. acidophilus,* and to some extent was able to produce caries *in vivo*.

In a previous paper, we reported the results of a rather intimate observation of twenty-two children, ranging from 5 to 13 years of age, for a period of six months. Eight of the children had some manifestation of dental caries and they all yielded cultures positive for *Bacillus acidophilus* during the six months.

At the time of the first examination, fourteen of the children were free from dental caries. Ten of these gave a negative reaction for *Bacillus acidophilus,* while four gave a positive. Of these four, three developed cavities in most of their teeth. The ten children who were negative for *Bacillus acidophilus* remained free from caries during the six-month period. This and subsequent studies confirmed Bunting's findings and suggested also the presence of the infection at least three months prior to the

manifestation of the disease, a sort of pseudo-incubation period.

Following Bunting's suggestion that the treatment of the disease be concentrated directly against overgrowth of *Bacillus acidophilus* in the mouth, we now have under observation more than 200 children. These youngsters are seen each week and cultures are taken of their teeth. Most of these children, when first examined, had no caries and were free from *Bacillus acidophilus*. In the event that some of them become infected, an attempt will be made to eliminate the organisms before the formation of the lesion, various medicaments being employed. The children who already have dental caries first receive the necessary operative treatment at the Rochester Dental Dispensary and then are given the anti-acidophilus treatment. The results of this study will be given at a future date.

Not infrequently, *B. acidophilus* may be obtained from mouths apparently immune to dental caries. In these cases, the organism is but a transient inhabitant of the mouth, probably remaining only for a few hours. Such a condition is clearly illustrated in the case of a medical student from whom was isolated a strain of *B. acidophilus* despite the fact that he had never had dental caries. Four cultures were taken each day over a two-week period. *B. acidophilus* was isolated twenty-three out of fifty-six times. In no instance could the organism be demonstrated in the mouth throughout the entire day. Most of the positive cultures were obtained before 2 o'clock in the afternoon, usually immediately after breakfast. The cultures taken late in the afternoon were, with but three exceptions, negative. Of further significance is the fact that strains isolated from this individual were not all of the same type.

Certainly enough evidence of the conspicuously important rôle played by the aciduric bacteria in dental caries has been presented to warrant the serious attention of dentists. The old slogan that a clean tooth never decays has been universally challenged as false. We doubt very much that an acidophilus-free tooth will decay. The dentist should avail himself of the facilities necessary in order to recognize the presence of *Bacillus acidophilus* in his patient's mouth so that he can institute intelligent prophylactic measures against the onset and spread of the disease.

ORGANIZATION OF POSTGRADUATE AND GRADUATE INSTRUCTION: SUBJECTS, TEACHERS AND DEGREES*

By WILLIAM H. WELKER, A.C., Ph.D., Chicago, Ill.

MY interest in the subject of organization of postgraduate and graduate instruction rests in the belief that the promotion of graduate work especially offers tremendous possibilities for the development of dentistry and the service of the profession to the public. It is common knowledge today that the most efficient teaching can be accomplished only where there is an atmosphere that is conducive to the development and extension of the borders of our knowledge. In other words, the research atmosphere is an absolute essential for the best type of instruction. The teacher who is not actively contributing to the advancement of his field soon becomes stale and fails to inspire his students.

For fear that my attitude may be misinterpreted, I wish to say that I believe that real teaching is the first function of the teacher. If the qualities of the teacher are lacking in an individual, no amount of research ability can ever make up for this deficiency. In order that the able teacher may do the largest amount of good in teaching, he must also have the ability to produce, as far as his field is concerned. At the present time, with the dearth of real teachers in dentistry, there is not much place for the individual who is purely a research man and has no ability and no particular desire to teach. It appears to me that the most effective way by which the research spirit can be stimulated is through graduate instruction, by which we understand the type of instruction that stimulates independent thought.

Perfection of mechanical manipulation, or the repetition of such manipulation, without the definite call for independent reasoning as the main object certainly should not be designated as graduate instruction. This method not only encourages the teacher, but also offers opportunity to the student who is qualified, to undertake original work. The development of the investigative idea in the mind of the student would appear to be a matter of profound importance since in such development lies our hope of securing properly trained and inspired teachers, and also the hope of advancing the science of the profession. We are familiar with the fact that the profession of dentistry is all too near the mechanical stage. In order to remove it from the ever-present danger of its relapse to a trade, it is necessary to advance the border lines of the scientific knowledge on which our procedures are based.

Now from the man who has no sympathy with the point of view which I have advanced, or from the man who has too much mental inertia actually to go to work and make the contribution which he owes to his profession, the idea is

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presented that most of the so-called research work really amounts to nothing. This argument has been used by some persons of my acquaintance to a point where it is worn threadbare. Every addition to our known knowledge, no matter how small, will ultimately serve human progress. Our epoch-making discoveries are based on, and are made possible by, little portions of apparently small, unimportant and unrelated scientific knowledge. These have been contributed by men who usually remain unknown and unsung, but who were inspired by the desire to know. Such an inspiration is much more important for the individual than his actual discoveries. An individual so inspired lives his life to a much higher degree than the man without it. His influence will live long after he has been forgotten.

In answer to our critics, I should like to point out that even the most astute scientists of today are not competent judges as to the value of any particular isolated fact that is discovered. It is only after the full picture has been painted, which may be in a year, ten years or even one hundred years, that the full import of this contribution may be realized. The inspiration that comes to a man who becomes infected with the desire to know, is so profound that were all his work to amount to nothing he would still have been a very much happier, and a very much more useful member of the profession, than without this inspiration.

Human motives are not always based on idealistic views of life. Occasionally, we find a man who has been stimulated to engage in investigation by motives which did not have the search for truth as their objective. I believe that these are "rare cases." Scientific integrity and a sincere thirst for knowledge are requisites, if the desired results are to be obtained.

Graduate work in dentistry, or in any other field, in my opinion, is most efficiently conducted and stimulated if under the control of the graduate faculty of the university, or institution, of which the respective college of dentistry happens to be a part. Under such an organization, selection of men to qualify for graduate work becomes comparatively easy. For such selection, abstract judgment is required. The graduate faculty is certainly better qualified to make a selection on this basis than the faculty from which the man is to be selected. Obviously, a man qualified to conduct graduate work must have had the requisite training and also successful research experience.

The total amount of real research work that has been conducted by the teachers in dentistry has been most pitifully small. The most serious criticism that can be applied to the teachers is not that they failed to conduct investigative work but that they did not strongly attempt to change a system that practically made it impossible for them to devote any time to research. On the basis of the actual teaching hours of the most of the dental faculties throughout the country, I am surprised that any individual members have had the fortitude to undertake research work. With the management of graduate instruction in the hands of the graduate faculty of the institution, one of the first questions that is asked concerning a possible candidate for election to the graduate teaching faculty is: How much time does the individual have available? On the terms under which most graduate faculties are operating, and on the basis of the number of hours that most of the teachers on dental faculties are devoting to under-

graduate instruction, under our present system, I doubt that more than a handful of individuals could qualify. I believe that the time has come when the members of the faculties of our dental schools ought to be given a reasonable amount of time for research, reading and reflection. There is no question that such a procedure would greatly improve the quality of the undergraduate instruction. I have had a feeling for a long time that most of the members of the dental faculties were being "taught to death." With the graduate faculty in control of graduate work in colleges of dentistry, I believe that we would have a very potent influence working toward the correction of an abuse that certainly does need correction.

Another factor that has seriously mitigated against productivity in the field of dentistry is the divided interest of the teacher. There is no question that, in a good many instances, dental teaching has been used merely for a "tiding over" until a private dental practice could be established. It is only human nature that the man who is giving part of his time to dental teaching at a salary that is a mere pittance should have his main interest centered on the source of a larger portion of his income. The man who is giving a certain portion of his time to dental teaching and conducting a private practice must be an exceptional individual indeed to carry out, in addition, successful scientific investigation, or to do successful graduate teaching. I do not believe that our dental faculties should consist solely of full-time teachers, for the influence of the practice of dentistry should be felt in the dental educational halls; but I do hope to see the day when a much larger percentage of the members of the dental faculties are on a full-time basis and are looking forward to devoting their lives to the teaching of dentistry and to the advancement of the science of dentistry. There is little evidence that any appreciable number of this type are in existence in the field of dentistry today. We can improve matters greatly by cultivating this type.

In spite of the serious handicaps that have existed in dentistry, a small number of men have been so fired with enthusiasm that they have made valuable contributions to the field of dentistry. I should like to cite a few outstanding examples of such men, and I am indebted to Dean Noyes of the College of Medicine of the University of Illinois for the critique on the importance of these men to dentistry. G. V. Black is regarded as the father of modern scientific dentistry. One of the striking features about Dr. Black's work is the great diversity of his activities. Dr. Black's important contributions were not confined to one special field of dentistry, but covered a great many different fields. He laid the foundations for the conversion of dentistry from an art based solely on manipulation to a science based on fundamental scientific knowledge. The second example is W. D. Miller. Dr. Miller, in his work in connection with dental caries, was the first man definitely to link up bacteria with disease. No one can deny that this was a basic discovery. Many other names might be mentioned, but these two illustrations will suffice. Even under the most adverse circumstances, inspired individuals will overcome all obstacles and contribute to the advancement of the field. For the attainment of such a desirable end, all obstacles ought to be removed as far as possible, and thus the development of dentistry would be facilitated.

Under the management of the graduate faculty, the library facilities are

carefully considered. If contributions are to be made to the knowledge on a subject, it becomes necessary first to determine what has been accomplished up to the present date. Library facilities are therefore definitely a part of the necessary equipment for the conduct of graduate work. Textbooks are of little value in this connection, for, as has been aptly said, they are frequently out of date before they are off the press. Complete files of all journals in the direct and related fields must be available, as well as the more important monographs. It is necessary for the research worker to go to the original sources for his information. It will develop his judgment in arriving at an accurate estimate as to the applicability of the methods used in the experimental work of the preceding worker and also in determining the validity of the conclusions that have been drawn on the basis of the experimental evidence. There is renewed stimulus toward an accurate consideration of the library facilities when viewed from the standpoint of graduate instruction.

Graduate instruction requires research equipment. One of the potent arguments for the expenditure of funds for such equipment would be a statement from the graduate faculty that certain men could be added to the list of graduate teachers provided the necessary equipment was secured.

Now as to the subjects for graduate instruction: Any subject of the dental curriculum in a given school which is being taught by teachers of established reputation in research and who are actively making valuable contributions to their field, and who have sufficient time to handle graduate instruction, might well be regarded as a proper subject for graduate instruction. The qualified teachers in such subjects should be permitted to conduct graduate work.

In a number of universities, the fundamental science subjects in the medical and dental curriculums are taught by the same departments. This arrangement permits of organization of the departments in a much stronger fashion from the standpoint of personnel. It makes possible the more efficient use of the apparatus and, therefore, permits more complete research equipment.

In the matter of degrees, I am heartily in accord with President Wilbur of Stanford University, who deplores the fact that, at a certain point in a man's educational career under our present system, it becomes necessary to indicate that something has happened to him. We indicate this happening by offering a degree. This custom is one strongly established. In all probability we will have to continue to indicate that something has happened to an individual by this method. As long as the academic world is following this course, there would appear to be no reason why a man who has completed a year of successful graduate work should not be accorded the degree of master of science.

By the same line of reasoning, there seems to be no valid reason why the doctor of philosophy degree should not be granted in dentistry under the same conditions that are required in the other fields in our universities. All such candidates of course should be able to demonstrate mastery of their selected field and also have proved their ability along the lines of independent thought.

The discussion of postgraduate or extension work places me in a rather serious dilemma. While I have studied the problem and have listened to many discussions on the subject, I have not had the close personal contact with this phase

of activity that I have had with the graduate phase. There are a few considerations, however, that I should like to present to you. In the first place, I do not believe that a professional school has ended its responsibility to the student when, at the end of a definite period of training, it indicates that the student has met the requirements for a given degree. Our organization should be such that any man who is out serving the public, and who feels the need of further training to improve his service to the public, should be afforded the opportunity to come back and receive such training. In other words, the doors of our institutions ought to be open to each and every one of our graduates who desire to improve themselves to a point where they can render more efficient service to the public. I am not now speaking of specific training for any special subject. The courses now offered in extension or postgraduate courses are entirely too fixed in their content and, as a rule, consist too exclusively of mechanical training. I believe this criticism applies to undergraduate instruction as well. There seems to be too much "rule of thumb" teaching and not a sufficient amount of the teaching of fundamental principles, as applied to the procedures to be studied. The fitting of the patient to the denture is quite a different mode of procedure from that used by the engineer who builds a dam or bridge specifically to fit the contour that Nature has provided. The difference lies in the method of instruction used in the two professions. The dentist is taught the technic of making a certain type of denture without having the principles underlying the procedure ever deeply reach his consciousness; while the engineer is taught the principles.

CONCLUSION

I should like to quote from a letter written by Dr. Gies. My work for the doctorate degree was carried out under his direction and much of the inspiration that has come to me, I believe, can be traced directly to his influence. It is a pleasure to make this acknowledgment. The quotation is as follows:

> The promotion of graduate work is one of the greatest opportunities and heaviest responsibilities of the best schools, for the most effective teaching, the most useful research, the most inspiring leadership, and the greatest progress are dependent upon it in dentistry as in every other field of intellectual activity.

ORGANIZATION OF THE CLINIC TO BEST SIMULATE CONDITIONS THAT SHOULD OBTAIN IN THE GENERAL PRACTICE OF DENTISTRY IN THE AVERAGE COMMUNITY*

By GEORGE W. WILSON, D.D.S., Milwaukee, Wis.

BEFORE attempting to prepare a discussion of the topic assigned to me, I took the liberty of changing the title to read: "Organization of the Clinic to Best Simulate Conditions that Should Obtain in the General Practice of Dentistry in the Average Community," substituting the word "clinic" for "infirmary" and inserting "should" before "obtain."

This change in the wording of the title seemed necessary because I am not satisfied with conditions which actually do prevail in the general practice. Consequently, a literal interpretation of the title as assigned would not afford the opportunity to set forth my conception of a proper clinical organization. This discussion, therefore, will not be based upon conditions which I hold actually do exist in the general practice, but upon an improvement of those conditions.

The influence of the unmistakable progress which has been made in dental education and which is exemplified in the recently revised curriculums of the dental schools has not yet sufficiently manifested enough of an influence on the general practitioner to improve appreciably the conditions which surround him in his practice. The principal factors which I hold to be accountable for delaying a more favorable improvement are, first, the want of recognition to which dentistry is entitled as a division of health service, and, second, the failure to organize office practice upon an efficient basis.

In recent years, dental education has made undeniable and rapid progress, based upon a broader concept of the purpose and scope of dentistry. The recognition of the possibilities of health dentistry by educators has gradually elevated its purpose above its former position as merely a mechanical art.

The average general practitioner of today is still too largely a mere craftsman. He still makes superficial oral examinations looking to the restoration of impaired function, but does not give proper attention to the biologic aspects of his calling. It is to be regretted that oral health service has not as yet been sufficiently recognized by either the practitioner or the public as a most important factor in maintaining health. In order that he may assume his rightful place in the professional and social structure and enlarge on his field of usefulness in the promotion of public health, the practitioner must effectively incorporate the scientific phase in his practice. Not only that; but in order to apply the

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scientific phase, he must give serious consideration to the matter of a practical working office organization. The practice of health dentistry will not become a reality as long as the practitioner fails to recognize the need of a well-planned organization of his professional efforts.

These are the improvements which I maintain to be the necessary additional features of general practice, and which should actually and more universally obtain before we may constructively attempt a simulation in the organization of the clinic.

I do not intend to paint a pessimistic picture of the methods used in the average dental practice, for I fully recognize the profound and constant improvement which is taking place. In fact, I am confident that the graduate of our improved curriculum will eventually bring about the improvements which I have brought to your attention, because he will be better trained in the sciences as well as the constructive art.

The striking analogy that exists between private general practice and clinical practice makes it desirable to organize both on a similar basis. The student begins the practice of his prospective profession when he enters the clinic. The purpose of the clinic should be to correlate and apply the principles taught in the basic sciences, mechanical, ethical and economic courses, with a view to preparing the student to enter general practice later as a safe beginner. Practice in the clinic is the culmination of the undergraduate desires of the student to develop his natural corrective and creative tendencies and to prepare himself earnestly for a future realization of them.

The desire for a thorough training in clinical practice is, I believe, more apparent among the students each succeeding year. This favorable change in attitude may be attributed to the effect of their liberal arts training, which has created in them the urge to attain the broader values of a professional life.

The period in the clinic is a most impressionable one, and the training received there unquestionably exerts a decided influence on the early years, at least, of practice. With a recognition of the added importance of our responsibilities as dental educators, it is imperative that clinical organization and conduct be given thoughtful consideration, with a view to a rational training which may be effectively applied after graduation to the building of a general practice.

It will be my purpose therefore to deal with a clinical organization which is designed to carry out effectively the purpose of the clinic, and duplicate as far as possible conditions that should obtain in the general practice. A résumé of the clinical organization now employed by Marquette University Dental School, which was designed particularly to simulate the improved conditions which our graduates will encounter in professional practice and which represents a practical application of the principles that I am discussing, will be here presented. The organization of our clinic is founded upon the following principles, which we hold to be the fundamental needs for a full and harmonious development of the student's faculties, as well as for the building of a successful practice.

1. Dentistry is recognized as an important division of health service and of equal importance with other specialties of medicine. Dental disorders are directly related to general health.

2. The application of this principle recognizes the fact that a knowledge of the sciences and their practical application is of equal importance with the

mechanical art of restoring impaired oral function.

3. A rational effective routine order of conducting the practice must be developed, embodying registration, examination, diagnosis and treatment involving the rendering of oral health service.

4. Initiative and self-reliance are necessary personal qualities of the student which are vital to his professional development, and hence must be inculcated to a high degree of perfection.

5. The ethical and economic phase of dentistry must be recognized as being extensively involved in the building of a successful practice.

The patient who applies to our clinic for dental service for the first time is registered in duplicate on the examination chart. The usual information regarding name, address, age, weight and occupation, including the name of the student operator requested, if there is a choice, is recorded by the registration clerk stationed in the waiting room. Some attempt is being made to select patients in accordance with their financial rating. We recognize a class of patients that is worthy of the advantages of a clinic and another class that can afford to pay the fee of the regular practicing dentist. This economic classification of patients presents a difficult problem and one which fortunately will not be similarly encountered in office practice.

The patient is subsequently admitted to the examination room for preliminary consultation with the examiner, who determines the proper assignment of the patient. A large number of patients are directed to the exodontia clinic or to the prosthetic department and never reach the general operative clinic. The distribution of patients to the operative clinic is a selective process, based on the operative needs of the student. Record cards showing student accomplishment are posted weekly in the examination room for the purpose of assisting the student in maintaining a balanced program. Patients are assigned, whenever possible, to the student who is lacking in certain types of work. Selective assignment of patients is essential for the consistent development of the students' professional skill. Concerted effort for prolonged periods on some particular phase of practice to the exclusion of all others would not result in a harmonious development. I refer to the attempt of some students to fulfil completely the requirements in denture prosthesis or in any other branch early in the year, neglecting the other branches. If this were permitted, further effort would not be made in those branches later in their clinical practice when the improvement which naturally follows from a distributed experience would assist them to produce a more satisfactory result.

Following the assignment of a patient to a student, the initial examination is made by him at his chair in the clinic, no instructor being immediately present at the time. He is made to rely upon his own judgment. We desire to train the student to deal with conditions which will confront him in practice and, therefore, we allow him to draw his own conclusions. We have found that this plan develops initiative, exactness, self-assertion and reliance in our students, all of which are desirable personal and professional qualities. A greater interest is manifested by the student in his patient because he will have the opportunity of applying his diagnosis and experiencing the result of his plan of treatment. The student is also afforded the opportunity of establishing a personal private contact with his patient much as he

would in practice, which is essential to the development of mutual confidence. This valuable contact is not possible in the examination room, owing to distraction caused by the immediate presence of others. The details of the examination, diagnosis and plan of treatment are recorded in duplicate; the original is retained by the student until the termination of the service, and the duplicate is filed in the clinic office.

The ordinary student could not be expected to make a thorough, reliable and systematic oral examination unless he were specifically trained in the fundamentals. This instruction is imparted to both the junior and the senior classes by a series of lectures, supplemented by group instruction. We are of the opinion that specific instruction carried out in this manner is more thorough and effective in attaining its end than is the comparatively hurried instruction imparted in the examination room.

It is a definite rule with us that the student must give each new patient a prophylactic treatment. This is the first operation in all cases, unless the patient is suffering, when the alleviation of pain becomes the first duty of the student.

Upon completion of prophylaxis and examination, the student is required to return with the patient to the examination room for the purpose of having his work approved and his examination, diagnosis and plan of treatment verified before the beginning of reparative work. The faculty examiner then goes over the examination chart with the student to determine the accuracy and correctness of the survey. Usually this is done in the presence of one or more other students who are present by assignment and who benefit by the experience of their classmate. If all this has been satisfactory, the patient is returned to the clinic for the institution of treatment. If the faculty examiner does not approve of the student's plan, criticism follows and the necessary changes are made.

Patients who present themselves for dental service may be divided into two groups. In the first group are those cases which require the usual oral examination in anticipation of restoring impaired function of dental organs, in the absence of systemic complications. The second group consists of those patients who present themselves because of actual, or possible, systemic complications and require a more thorough examination. Those of the first group are undoubtedly in the majority, and after the acceptance of the prophylactic work, examination, diagnosis and plan of treatment, the student returns with his patient to his chair in the clinic to begin his dental operations. Those of the second group are given a searching investigation before the diagnosis is completed. I wish here to emphasize the value of the chemicopathologic laboratory in immediate connection with a dental clinic as a most valuable aid in making a diagnosis in dealing with the second group of patients referred to in the preceding statement. Its function is to provide facilities where students may scientifically investigate any pathologic condition by means of the blood count, blood pressure, coagulation test, urinalysis, Wassermann test and microscopic examination. In the light of our present knowledge, a diagnosis would not be complete in the presence of systemic involvement without making use of laboratory findings. The diagnostic laboratory is also of valuable assistance in determining the physical fitness of the patient to submit to a general anesthetic for surgical operations. Again, it may be employed to advantage in determining the coagulation time of the blood, pre-

ceding a surgical operation in questionable cases.

The constantly increasing responsibilities of the dental profession make it imperative that the dental practitioner be trained to the highest possible standards of scientific knowledge. It is entirely within his province and plainly his duty to determine what shall be done to improve the health of his patient by eradicating oral disease. It then becomes necessary, in a broad clinical training, to employ every means at our command to attain this end.

The diagnosis of oral disease and a clear understanding of corrective measures are necessary to elevate the profession to a higher level of public value in promoting the general health. Bringing the educational value of laboratory tests to the dental student and making him familiar with the interpretation of reports will place him in a position to cooperate intelligently with the physician. This will eventually lead to a greater respect for the opinion of the dental practitioner by his colleague. Experience gained while in the clinic making examinations, diagnosis and plan of treatment, organized in this manner, can be directly applied to the conditions encountered in the private practice.

The student is always given special assistance by the instructor in arriving at a diagnosis in complicated cases. It is customary to permit him to express his opinion by judicious questioning. Frequently, other students are called in to join the discussion in cases of particular interest. I do not intend to infer that the dentist should be expected to equip such a laboratory of his own for diagnostic purposes; this should not be expected. Occasions will frequently arise in the practice of the conscientious dentist on which it will be necessary for him to refer patients to such a laboratory before a thorough examination can be made. If he were unable to express an intelligent interpretation of the findings, he could not possibly deal with conditions effectively.

The zone system employed by many schools and formerly at our institution is no longer considered either necessary or advantageous in our clinical organization. This system was not abandoned because it lacked merit but because of the relatively smaller classes resulting from the recently extended curriculum. Supervision of clinical practice can be effectively carried out by the instructors in their respective fields without undue effort, because of the smaller classes. Consequently, the student carries on a general practice at his chair, in striking similarity to an office practice, except for special service such as roentgen ray, exodontia, oral surgery, denture prosthesis and diagnostic laboratory service.

At the termination of each sitting, the patient is given an appointment card bearing the time of the next appointment. The card also bears a reference to the necessity of keeping appointments, such as would obtain in the office practice. The call card is employed by the student in all cases which require a followup or checkup. These methods of making appointments and following up cases are valuable to the student as they closely simulate customary procedures in the well-organized dental practice.

Time will not permit me to present the routine order of instruction in the various divisions of practice in the general clinic. In passing, I may state that instruction in all branches is largely by suggestion or indication rather than by demonstration. We hold that it is to the advantage of the student to be aggressive and to work out his own problems as

much as possible, keeping in mind the limitations of the student's knowledge and the ethical rights of the patient. The danger of overinstruction or spoon-feeding is always imminent. As the disastrous effects of such training on the development of the student is recognized, special attention is directed toward its elimination.

The application of this method calls for specialized instruction in all of the divisions of clinical practice. In our experience, the group instruction method has proved to be highly satisfactory. The process of teaching with this method is by example and demonstration and affords an opportunity for each student of the group of ten to observe and thoroughly establish in his mind the successive steps involved in a complete operation. This work is carried on at Marquette during the entire year in a separate operating room with junior and senior students in attendance. A marked improvement is observed in the greater self-sufficiency of the student after each instruction period. Deficient students are required to attend several classes of special group instructions until a marked improvement is shown. Judging from the results obtained and the interest manifested by the students, this system of instruction in our school is unquestionably a success.

It is but human desire to expect proper remuneration as a reward for services satisfactorily rendered. While the dentist is compensated in terms of fees after graduation, the student should receive his reward in terms of credit units. The matter of scholastic credit is an economic feature of clinical organization which requires careful consideration. The requirements of a system are twofold: first, that it shall represent a just credit value, significant of the efforts of the student in time given to the completion of the service, and the excellence of results; second, it should simulate in a measure the equivalent of remuneration in terms of units which is customary in practice in terms of money for a given operation. The intrinsic value of the system lies in that it indicates to the student the various factors on which a just fee may be computed after entering practice; namely, the approximate time consumed in performing the operation, the degree of excellence of the results and the worth of the service to the patient.

A great deal of criticism, much of which is justified, has been leveled at the dental schools because of their failure to give the student a proper knowledge of professional ethics and economics. It is my opinion that there is a rightful place in the dental school curriculum for such a course of instruction. It certainly cannot be denied that there is a business transaction between the dentist and his patient. Consequently, it is our duty to the student to guide and influence that relation in the proper direction. A great deal of the distress and failure existing in the practice of dentistry today are due as much to ignorance of sound business principles as to the neglect of them. I do not infer that a dental practice should be so conducted that the commercial element should dominate the professional; that would be disastrous. A dental graduate who has received no systematic training in the economics of his profession during his undergraduate days will obtain his knowledge elsewhere after graduation, often from undesirable sources, and herein lies the real danger of his being directed into the objectionable, unethical practice of the advertiser. A course presented under proper direction in the dental school based upon correct ethical principles is the logical source

of the practitioner's knowledge of business and professional management. We have recognized this need, and, as a result, a course of lectures and discussions in professional ethics and economics is being given for credit at our school during the second semester of the senior year. The principles taught in this course are applied in the dental clinic wherever possible.

During the past year, a revised system of giving scholastic credit has been instituted at our school clinic based upon the foregoing logical and easily understandable values of reward in terms of credit units to the student. The unit of credit value is based upon the approximate average time devoted to an operation, determined from data which were gathered from specially appointed average students. It is known as the unit hour. The total number of unit hours of clinic requirement represents the number of clock hours devoted to clinical practice, less 10 per cent to allow for inevitable losses of time during the period.

The total number of clock or productive hours of clinic practice during the senior year, which in our institution is 900 after deducting 10 per cent for inevitable loss, is divided proportionately into the following groups:

1. Operative dentistry.
2. Prosthetic dentistry (including crowns and bridges).
3. Pathology.
   (*a*) Root canal therapy.
   (*b*) Periodontia and preventive dentistry.
4. Orthodontia.
5. Oral surgery, exodontia, anesthesia.
6. Radiodontia.
7. Oral diagnosis.

For purposes of illustration, and yet avoiding the tiresome details of reciting the entire system, I have selected the division of operative dentistry as being typical of its operation.

A total of 300 clock or unit hours is assigned to this division of clinical practice. This number is arbitrary in the sense that it was established according to our concept of the importance of the subject in relation to the general practice. Of this total, the various filling operations and the assigned requirements of each group are here given as follows:

Gold foil, total unit hours	95
Gold inlay, total unit hours	95
Amalgam, total unit hours	45
Silicate cement, total unit hours	45
All other fillings, total unit hours	20
Total unit hours	300

The approximate time consumed for the average operation for each class of cavity, determined in part from data presented by a selected group of average students, is found in the accompanying table.

TIME DATA FURNISHED BY GROUP OF AVERAGE STUDENTS

	Classes	Credit Clock Hours	Credit Unit Hours
Gold foil	1 and 5	3	3
	3	4	4
	2 and 4	5	5
Gold inlay	1 and 5	3	3
	2 and 4	4	4
	2 and 4 (mesioclusodistal)	5	5
Amalgam	1 and 5	2	2
	2 and 4	3	3
	2 and 4 (mesioclusodistal)	4	4
Silicate cement	5	2	2
	3	3	3

The number of unit hours of credit attached to each of the foregoing operations is significant in observing the balance of the students' record card. For example, if the majority of unit hours of credit in gold foil operations appear

too frequently to be 3, the conclusion is that the student is not receiving a diversified experience in gold foil. Every time a credit of 3 unit hours appears on the record under gold foil, it means the filling was either a Class I or V, representing the simpler types of cavities, and the student is advised to seek other types of cavities. The quality of each operation is signified by A, B, C. A grade of D is not accepted as satisfactory and the operation is repeated.

This feature of our organization has been functioning since September, 1928, with satisfactory results. The value of credit is interpreted in terms of unit hours. The unit hour is based on the approximate time consumed and the quality of the work, both factors which form the basis, in part at least, for the determination of dental fees in practice after graduation. Under this plan, the clinic office transacts all business and keeps records, and the student is not burdened with the details of keeping an individual set of records. We believe that his time in the clinic can be more profitably spent in the development of professional efficiency, especially since his training in dental economics is so carefully planned and watched over. Instruction in fundamentals is of first importance. Application of details can readily be instituted subsequent to graduation.

In this paper, it has been my aim to present to this group suggestions for a rational, workable, clinic organization designed to carry out the purpose of the clinic and to simulate as far as possible, conditions that should obtain in the general practice in the average community.

The plan of organization is founded on the five fundamental factors that have been mentioned, which are held to be essential to the building of a successful dental practice. The benefit derived from the training given the student by an efficient clinic organization will be to prepare him to enter the profession and establish his office practice on an efficient, professional and economic basis.

If we can attain our objectives, the general practice of dentistry will in turn eventually be elevated to a broader field of usefulness and held in greater respect by the public. Dental education will then achieve the realization of its purpose and effect an improvement of those conditions which actually do obtain in general practice in the average community.

DISCUSSION

LeGrand M. Cox, Chicago, Ill.: General procedure as to the registration, examination, diagnosis and student's plan of treatment, as outlined by Dr. Wilson, is correct. It is one which we have followed for many years in the institution with which I am connected. We can readily see that the zone system would not be of practical use where there is a limited number of students; but it is very effective when there are at least five instructors covering each zone of about eighteen or twenty students. It not only conserves the instructor's time, but is also advantageous to the students. There is a phase in the development of clinical instruction which has unfortunately been neglected in the past. Instead of applying more pedagogic principles to develop our clinic to the fullest extent, there has been a tendency to adopt principles which have been gathered from simulating office practice. This is exemplified by the professor of mathematics who is not so much interested in flooding the market with human comptometers as he is in developing the mentality of his students. Hence, it would seem fitting that an effort be expended to develop our clinical teaching along educational lines rather than concentrating on office practice. I should like to add one point to Dr. Wilson's comments in regard to group instruction. We have found this method of instruction so valuable that we have organized what we call our student advisory system. At the beginning of the junior year, each student is assigned to a faculty adviser, one of the older, experienced men of the faculty. The student is then expected to con-

sult his adviser and receive such help as will make his clinical experience of practical value to him. The first week he is also required to serve one week's internship under a senior student in order to become familiar with routine clinic practice. He then has his first patient assigned to him. This system of advisers seems to be as successful as similar plans in our leading colleges and universities. If a student does his part, he may avail himself of the experience and judgment of an older person, and may form a friendship which will be of lifelong value. The adviser is always ready to serve in any possible way; but if the student is heedless of his opportunities, he receives no benefit from the system.

I do not believe that this paper should go unchallenged in regard to Dr. Wilson's theory of giving scholastic credit known as the unit hour. It would be fine if he could be substantiated in the conclusions that he has brought forward. From the apportionment of the 900 hours, I do not believe that a student would become proficient. In the first place, the student would have a certain number of clock hours in each clinical department to fulfil regardless of the amount of work completed. The poorer student could be merely filling in time, and still meet the requirement. Using unit hour credit, there would be a varied amount of work completed by each student, and no uniformity in their individual skill. When we pause to analyze the work required to complete each operation, the difference between three unit hours for a pit or Class 1 cavity and five unit hours for a mesioclusodistal or Class 2 cavity would seem to be out of proportion. That the student must be trained scholastically as well as in the clinic is a point with which we are in hearty accord. We are using a plan that has long been in use—the point system—which we feel is the best device that has been offered for this purpose. By this system, if a difficult piece of work has been well done, there is opportunity for the range between high and low in the number of points given. For instance, we vary our credits from one to three points for Class 1 cavities, to eight to ten points for extensive restorations. The elasticity of the range of points makes it possible to justly reward the student. The credits in all clinical departments should be looked on as indicators of "progress evaluation" of the student's advance toward proficiency and not to "clock hours" of manual labor.

We believe that the establishment of the habit of completing all prophylactic and reconstruction work for every patient is of greater importance than the performance of a fixed number of piece operations of each type. However, a minimum of each type of procedure must be exacted in order fully to round out the clinical course. This naturally requires some trading of patients during the second semester. The elasticity of the point system must be under the supervision of an experienced clinic director. This system has proved to be a wonderful stimulus in our students to produce excellent work, because they readily recognize the governing factor to be the quality of the work rather than the number of hours spent in clinical work.

PRINCIPLES AND TECHNIC OF THE ROENTGEN RAY FOR THE GENERAL PRACTITIONER*

By CHARLES F. CHANDLER, D.D.S., F.A.C.D., Montgomery, Ala.

THE every day use of the x-ray transformer by the general practitioner is slighted, and the failure to take advantage of this aid to his practice results, in many cases, in the dentist's not rendering to his patient the best service of which he is capable.

It is not that dentists are ignorant of the value of the roentgen ray in the different branches of dentistry, but having got along without it, they cannot realize the great help that it would be to them in their daily practice until they have made use of this addition to diagnosis. It is not essential that the general practitioner expend a great deal of time or money in equipping himself to do this work.

It is not the intention to advise every dentist to equip himself with an x-ray transformer, but if you are so situated that you can refer work to a specialist in this line and are constantly making use of his service, you are rendering your patient as good service as if you were doing the work yourself.

The question naturally arises: Can the patient afford this service? I will answer by asking: Can the patient afford *not* to have this service? You are the judge. Can you afford to give your patients less than the best?

Every patient that complains of uncomfortable dentures is not necessarily a crank. Sometimes, a roentgenogram of the bone will convince the dentist that the trouble is with a roughened or saw-edge bone, and not with the denture or the patient.

Surely no periodontist would attempt to make a complete diagnosis of periodontal lesions, the amount of bone destroyed, the depth of pockets, effects of traumatic occlusion, and the devitalized teeth, without the aid of a roentgenogram.

Is it right for us to construct a bridge without knowing the condition of the teeth to which the bridge is to be anchored? We should know whether they are vital, the length of the root or roots, the amount of bone that has been lost around the roots and the size of the pulp.

No competent orthodontist would attempt to diagnose a case simply by looking at the mouth and taking a plaster model. He wishes to know the shape of the roots, whether there are any unerupted, permanent or supernumerary teeth or any impacted teeth, and any other facts that he can discover regarding the case that he is attempting to diagnose.

I believe that deciduous molars, whether loose or not, should be examined by the roentgen ray before extraction. This is not a radical practice.

*Read before the Section on Radiology, at the Midwinter Clinic of the Chicago Dental Society, Jan. 15, 1929.

It seems useless to call attention to the need of the roentgen ray in extractions. But I do wish to say that no permanent tooth should be removed without the aid of a roentgenogram, unless it is one that is very loose from periodontal disease, and even in these cases, we find things that will surprise us.

Last, but not least, comes the general examination for cavities. This is our every-day work. Regardless of all the discussion that has been brought about pro and con on this question, there is no doubt in the minds of the men who have used this method of its value in finding cavities that would otherwise be overlooked. If this method was routine practice in every office without charge, which I certainly do not advocate, it would more than pay for itself in additional work found and in added confidence of our patients.

How many of us have had the experience of having told a patient that we had finished all necessary work, and that his mouth was in good shape, and in a short time afterward had the patient return with a crushed in tooth, or at least, with a tooth which he was complaining of as being sensitive, and have found a large interproximal cavity.

I hope that the time will come when before we say that our work is completed, we shall check the work with interproximal films for all overhanging margins of crowns and fillings, and see that all cavities have been filled. After this check, we can say with some degree of certainty to our patient that his mouth is in good condition, and can know that he is getting the kind of dentistry that he deserves.

DISCUSSION

Albin A. Johnson, Chicago, Ill.: A mouth examination cannot be completed without the use of the roentgen ray any more than our ills can be diagnosed by a physician merely taking a look at our tongues or giving us a few taps here and there. When we have bodily ailments, we go to a physician in whom we have confidence, a person of good repute in his work. If he simply puts a few questions and examines us in a haphazard manner, we lose some of our confidence in him, especially if we obtain no good results. Patients with bodily ills confined to the mouth place themselves in our hands, and these ills, as we all know, are not always confined merely to the mouth but may affect various parts of the body. These patients ask for a mouth examination and that is exactly what they want. They have confidence that we will find everything that is wrong and possibly assure them of some things that are not wrong. How many times have we examined mouths without the use of the roentgen ray, given our diagnosis and completed the required dental services, only to find, after a few weeks or months, that everything was not as it should be. Perhaps some of these patients have returned to tell us the sad news, but probably they go to someone else, who does not believe that roentgenograms are superfluous even in the edentulous areas. These patients are usually in a frame of mind to have full mouth roentgenograms taken even though they are wearing partial or full dentures. They are anxious to see the case through to a finish and will cooperate. Full mouth roentgenograms are taken to begin with, and what is revealed when they are completed? Possibly, retained roots, impacted and supernumerary teeth, infected areas in the bone and at the root ends of seemingly sound teeth, cystic conditions, cavities large and small, and the deposits which were so carefully taken off a few weeks ago. Can we then be without the roentgen ray or the roentgen-ray service, and with these at least a reasonable amount of knowledge regarding their interpretation? It behooves us to give our patients the best obtainable, especially when it can easily be done.

THE RIBBON ARCH MECHANISM*

By ROBERT H. W. STRANG, M.D., D.D.S., Bridgeport, Conn.

IN presenting the ribbon arch mechanism for consideration, it is not my purpose to make any attempt to teach the technic of using it, but merely to analyze the principles involved and show how they are applicable to the treatment of certain cases that cannot be so successfully or so readily reduced to normal with any other form of appliance.

I make no contention that the placing of the teeth in the "line of occlusion," which means the normal positioning of tooth crowns and roots, will guarantee stability of location forever after. The moving of the teeth is but one step in the process of treatment, but it is a very important one and must be perfectly accomplished. The other steps, which are also of the greatest value, consist of reducing to normal form and activity those structures that are in any way related to the teeth in position and function. The muscles of the cheeks, lips, tongue, pharynx and neck must act harmoniously and in a perfectly balanced manner so that the forces focused on the dental arches and on the individual teeth will be sustainingly normal. The proper quality of the bone that is built about the teeth and affords them basal support must be assured by bringing the metabolic processes of each patient up to the standard needed to produce such tissue. Nervous tension must be reduced to a minimum, for it would seem that instability in this system is one of the greatest factors that we have to contend with in overcoming malocclusion and in its recurrence after treatment.

As I am writing about an appliance, I am naturally more concerned with tooth movements. Those who are not familiar with this mechanism are referred to an introductory article in the *Dental Cosmos*.[1]

There are two distinct sets of principles that must be considered when studying or analyzing a device designed for the movement of teeth. These are divided into physiologic and mechanical principles.

PHYSIOLOGIC PRINCIPLES

To meet the physiologic requirements, an appliance must be able to deliver a force with the following characteristics:

1. It must be of sufficient power to be stimulating to the bone cells, which means that it shall cause an increase in blood supply to the part and thus excite and develop a greater cellular activity.

2. It should not be powerful enough nor so sudden in its action as to be traumatic and so cause inflammatory reaction with blood stasis and cellular death.

3. It must be definite in the direction of its activity.

4. It should be so flexible as to be under perfect control.

*Read before the Section on Orthodontia at the Midwinter Clinic of the Chicago Dental Society, Jan. 15, 1929.

1. Angle, E. H.: Dent. Cosmos, 58:969 (Sept.) 1916.

5. It must be of uniform intensity throughout the entire period of its activity.

6. It should be continuous for a long period of time, the duration of which should at least cover the interval between arch modifications.

7. There should be no backlash to this force, causing the teeth to revert toward their original positions after they have moved in the desired direction to a greater or less degree.

By practical test, the ribbon arch mechanism has been found capable of delivering a force that contains all these physiologic principles; i. e., when this appliance is correctly used, it will deliver a gentle, stimulating force that is definite in its lines of activity and is continuous for a period far in excess of the usual interval between arch changes, which in my own cases is about six weeks. There is no back spring at any time in any of the teeth that may be laid to a relaxation in the appliance force. The force is steady and of the same degree at all times and is very readily controlled. Hence, we may state that this mechanism is ideal from a physiologic standpoint.

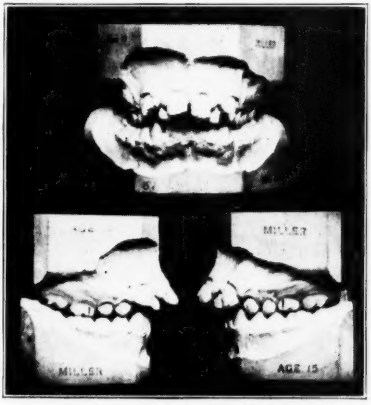

Fig. 1.—A Class I case with the upper teeth mesial to normal.

It is perfectly possible to use this device in such a way that it will violate any or all of these rules. It can be so adjusted that it will fail to deliver sufficient force to move the teeth; it can be made to be traumatic and cause inflammatory reactions about the tooth roots; it can deliver forces that are working along antagonistic lines; it can produce a force that will expend itself before the period between arch changes is over; and it can be so adjusted as to permit considerable recurrence in tooth position before its activity ceases. This, of course, is but another way of saying that this mechanism is not automatic, but must be used under the direction of a skilled operator in order to be effective.

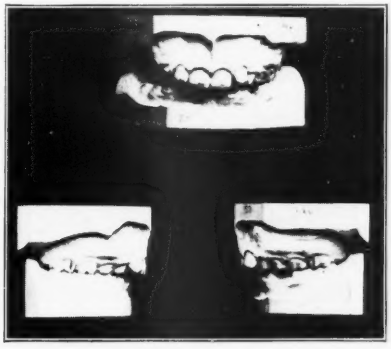

Fig. 2.—A Class II case showing the typical undergrowth in the body of the mandible.

MECHANICAL PRINCIPLES

The mechanical principles of an ideal appliance are as follows:

1. There must be perfect control over the tooth to be moved.

2. The appliance must be able to move the tooth crowns in any of the follow-

ing directions, i. e., labially or bucally, lingually, mesially, distally, torsally, occlusally or gingivally.

3. It must be able to move the tooth roots in any of these directions.

4. With it, the operator must be able to produce stability in certain teeth or groups of teeth, so as to have a base from which to produce movement in other teeth.

5. Its attachment to the teeth must be so strong as to resist all strains of displacement.

6. It must exhibit simplicity of adjustment.

7. It must be susceptible to universal application for the treatment of all kinds of cases of tooth malposition.

Fig. 3.—Appearance of patient in case shown in Figure 1. The well developed chin indicates a Class I case rather than a Class II.

8. There must be mechanical simplicity and perfection in its various parts.

Does the ribbon arch mechanism meet these various mechanical requirements? Let us discuss each one in turn.

1. Perfection of control over the tooth to be moved. There can be no question that the arch, seated and locked in the bracket, which, in turn, is stabilized on the tooth by means of the cemented band to which it is soldered, gives perfect control over that tooth.

2 and 3. Ability to move the tooth crowns and roots in all desired ways. This it can unquestionably do, as I shall demonstrate, if time permits.

4. Stability of anchorage. The curvilinear sheaths, soldered to the anchor bands, assure firm attachment to the anchor teeth and consequently stable anchorage. This can be increased to so-called stationary anchorage by proper arch adjustment in relation to the sheath and to the brackets of the anterior teeth, and can be done with greater facility and stability than with any other form of mechanism. Furthermore, auxiliary anchorage is everywhere attainable through the agency of the accurately fitting arch and brackets. This, of course, makes the problem of anchorage somewhat more complicated for the inexperienced, but of extreme satisfaction to the understanding operator.

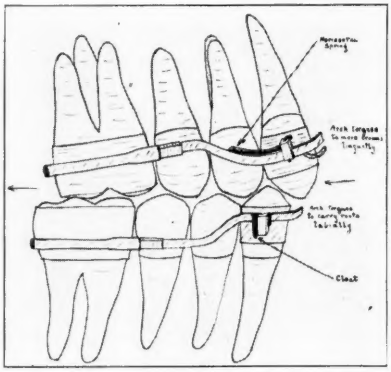

Fig. 4.—Application of the appliances for treatment of the case shown in Figure 1.

5. Security against displacement. This is one mechanism that most of the patients do not disturb. Weeks pass by, and still the appliance keeps its position

and remains in perfect working order. Children sent away for their summer vacation with this fixture in their mouths almost invariably report back with an undisturbed mechanism and with marked improvement in tooth position.

6. Simplicity of adjustment. On this point, the ribbon arch mechanism is further away from the ideal than in all other points. It certainly is not simple for the novice to use. It takes a long time for him to make a primary passive adjustment and nearly as long a period to modify it correctly, and it is hard

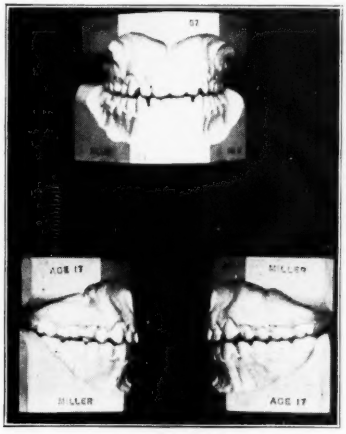

Fig. 5.—Result of treatment of the case shown in Figure 1.

work. But if the appliance is carefully studied and its technic practiced until mastered, it then becomes comparatively simple to handle. The adjustments associated with its use should always be made in the same way, and this is perfectly practical with such an accurate appliance, and thus the modifications become standardized, as it were, and so cease to be difficult or troublesome. Thus, simplicity of adjustment is eventually acquired.

7. Universal adaptability to all kinds of cases. No appliance comes so nearly being 100 per cent efficient in all cases as does this mechanism.

8. Mechanical simplicity and perfection. The various parts have been refined to the greatest degree.

To recapitulate: We find that this mechanism meets the mechanical ideal in perfection of control over each tooth; in being able to move crowns and roots in every desired direction; in the production of suitable anchorage; in resisting displacement from the mouth; in universality of application; and in the perfection and simplicity of its parts. Its one objectionable feature is the fact that it is difficult to manipulate, but this can be eliminated by studious practice in the form of systematic, technical manipulation.

PHYSICS OF THE RIBBON ARCH MECHANISM

This appliance acts by virtue of the power of a lever, a spring, a jackscrew and a torque. Most mechanisms that are in use today for moving teeth supply the first three power agencies, but the last force is a property of the ribbon arch alone and, as Dr. Brodie will show you, of the "newest mechanism." Therefore, it seems wise to study this force somewhat in detail.

The ribbon arch, having two parallel flat sides that rest in perfect contact with the walls of the brackets and curvilinear sheaths, will, when twisted upon itself, exert a pressure in opposite directions on the occlusal and the gingival edges of bracket and sheath. This force, which is extremely useful in moving the crowns and the roots lingually or labially, as desired, is called the torque force.

In order to avoid confusion of terms, the kind of torque placed in the wire is designated in terms of its action on the

crowns of the teeth. Therefore, when we say labial or buccal torque, we refer to a twist in the wire that will tip the crowns of the incisors, cuspids, bicuspids or molars, labially or buccally, while the roots of these teeth will be tipped lingually. By lingual torque, we mean a twisting of the arch that will tip the crowns of the teeth lingually and carry their roots buccally. Therefore, to move roots lingually, we use labial or buccal torque, and to move them labially or buccally, we use lingual torque.

Torque may be used on an individual tooth by limiting the modification of the arch to the section that is in relation to the bracket on the tooth to be acted on; or it may be used in the form of a so-called "mass torque," in which a group of teeth are acted on simultaneously by the twisted wire.

The latter force is of great service in helping to produce stationary anchorage when elastics are being used. Lingual mass torque in the incisor region stabilizes these teeth against tipping forward and also aids in elongating the molars, a tooth movement that is usually required in this type of case. Thus, it can truthfully be said that until one has mastered the many uses of the torque force, he is not a successful operator with the ribbon arch mechanism, for he is not able to take full advantage of all its power-producing agencies, and hence is losing about one-fourth of its range of activity.

HOW BEST TO ACQUIRE RIBBON ARCH TECHNIC

Although it is possible to familiarize one's self with this mechanism by selecting a few simple cases and using the appliance on these, it is far better to make a thorough study of the appliance on technic models before making practical application to the mouth. The best model for this purpose is one in which teeth are set up in modeling compound. These teeth should be placed in malalinement, and the mechanism applied to them. A detailed technic covering the primary adjustment of the arch in a perfectly passive state and every modification used

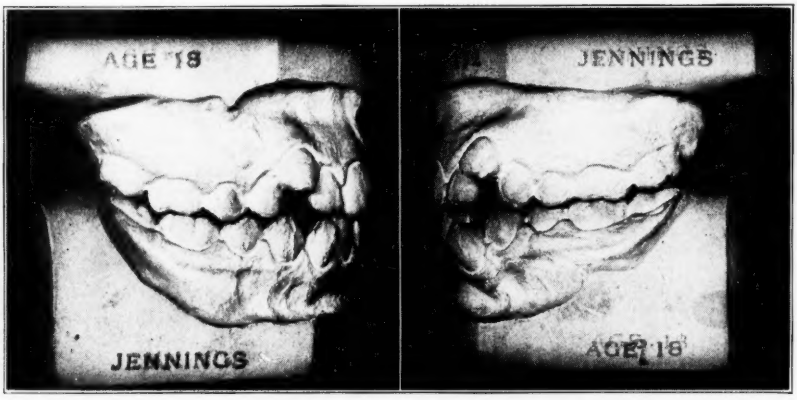

Fig. 6.—Case in which the teeth in both the upper and lower jaws have drifted mesially to normal.

thereafter for the production of tooth movements has been given in steplike procedure.[2] The arch should first be adjusted passively to the technic model and then the various changes necessary to bring the teeth into alinement should be made according to the technic described in this article. After each change in the arch form, it should be tempered, placed on the model and pinned into position. The teeth on which the pressure falls should be slightly heated with a small flame of the blow type, and the action of the arch will be accurately portrayed by the change in tooth position.

over root position of individual teeth; and of the use of mass torque force.

2. The opening of the brackets should not face toward the gum. To do so makes it exceedingly difficult to seat the arch, and one cannot study or determine the relationship of the arch to the bracket opening, which is the only way to ascertain what the action of the arch will be when seated.

3. A buccal tube with a round bore should not be used. The value of the curvilinear sheath, with its opening that accurately fits the arch, is too great to be sacrificed. One should train himself

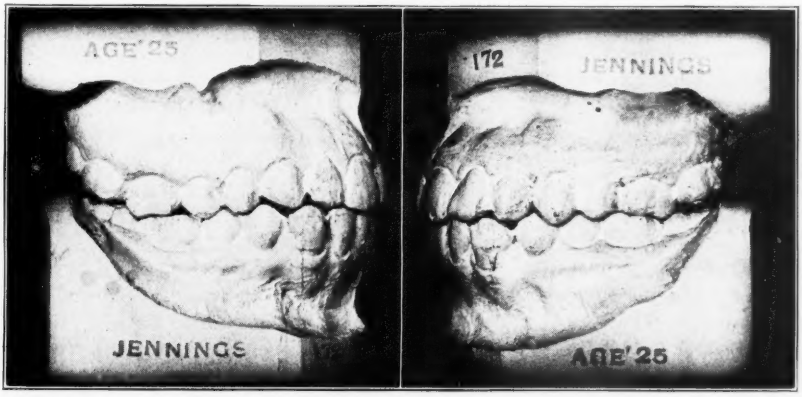

Fig. 7.—Result of treatment of the case shown in Figure 6.

COMMON MISTAKES MADE IN RIBBON ARCH TECHNIC

There are a number of errors that tend to creep into ribbon arch technic.

1. It is impractical to use this appliance with but two or three bracket bands in position unless these few banded teeth are the only ones that need to be moved. With such an adjustment, one loses the value of reciprocal anchorage; of stationary anchorage; of control

2. Strang, R. H. W.: Dent. Cosmos, 67:779 (Aug.) 1925.

to use it successfully.

4. Bracket bands should not be placed too close to the incisal edge of the teeth. This seems a universal error. The correct location is in the middle third of the crown. In other words, the incisal border of the band should be just as far away from the incisal edge of the tooth as the gingival edge of the band is from the gingival border of the tooth.

5. Most operators fail to keep the section of the arch in association with each band, parallel to the occlusal edge of the

band. When properly adjusted the arch should always be bent to lie at right angles to the long axis of each tooth. To do this may necessitate the placing of sharp, steplike bends in the arch when making the primary adjustment, but these are preferable to having the arch imperfectly seated in the floor of the bracket.

6. As regards variation in the horizontal alinement of the two curvilinear sheaths: unless these two tubes are kept in the same plane, the incisal section of the arch will be thrown into oblique alinement. When placed in the brackets, this would cause shortening of the anterior teeth on one side and lengthening of those on the other. While this can be overcome by proper bending in that section of the arch that lies between the tubes and the cuspid bracket, it is better not to be obliged to make such compensatory changes.

7. Failure to keep the wide dimension of the bore of the sheath paralled to the side of the molar band when resoldering these tubes for correct alinement will make it necessary to twist the end of the arch so that it will lie passively in the sheath. Otherwise, the molar will be badly torqued out of position.

8. Failure to adjust the arch passively to the brackets in the vertical dimension means that a torque force is active and the tooth root will be moved lingually or labially. The best way to determine such a condition is to place the corresponding section of the arch in each individual bracket and note whether the ends lie on the same plane as the buccal sheaths. If they do not, there is torque present. An arch that is perfectly passive in relationship to the brackets can be forced into position with the fingers. This is one of the best tests for a correct primary arch adjustment.

9. Allowing the arch to cross the bracket opening instead of being parallel to it means that the tooth will be rotated when the arch is seated.

10. Bending and distorting the arch when soldering attachments to it will, because this is such a delicate wire, from the mere weight of the ends be sufficient to cause it to collapse when brought to a soldering heat in a local area. I never do any soldering on a ribbon arch without first placing it in a holding device, designed to prevent just such a catastrophe.

11. Recording the arch form before making adjustments is important as it is impossible to gage the extent of the bends and their effect on the anchor ends of the wire unless one has some system of recording the shape of the arch and the position of its ends before modifying it.

12. It is a mistake to make the primary adjustment of the arch an active one. This appliance is so nearly perfect in the relationship of its various parts that the slightest deviation of the arch form from the bracket position will move the tooth a corresponding amount. In order to prevent tissue shock, the first two or three adjustments should not be greater than one-half the thickness of the outer wall of the bracket. Hence, it is wise to obtain an accurate bracket relationship to start with, so as to gage correctly these slight subsequent modifications. Furthermore, to adjust an arch absolutely passively requires expert technic; hence, there is liable to be some tooth shifting even when an effort is made to avoid it, especially if the operator is unaccustomed to this mechanism, and such tooth movement is sufficient for both the tissues and the patient to adjust themselves to it for the first time.

13. Failure to anneal and temper the arch properly before and after it is modified means that the arch will break when bends are made, and if not tempered uniformly, it will change its shape when sprung into the brackets. This, of course, is prohibitive to accurate and uniform tooth movements. Electric annealing and tempering is the only accurate and scientific office procedure.

PROOF THAT SUCH AN APPLIANCE IS NEEDED IN ORTHODONTIA

Having thus presented the principles of this appliance and discussed some of its technical problems, let us now study a few types of cases that cannot be so easily nor so successfully treated with any other form of appliance as with this one and the one which Dr. Brodie is to describe.

Group 1 comprises cases in Class 1, in which there has been a mesial or forward shifting of the molars, bicuspids and cuspids of the upper arch.

I first called attention to this type of case in a paper entitled "Pitfalls in Class 1 Cases."[3] Up to that time, I had found comparatively few cases of this kind; but with each succeeding year, there seem to be more and more of these deformities presenting themselves.

The reason for this seems obvious. These cases are caused by excessive muscular pressure on the sides and distal end of the upper dental arch, and usually this is in the form of a habit spasm of the buccinator, risorius, internal pterygoid, temporal and masseter muscles. These spasms are the outward expression of nervous discharges from an unbalanced, unstabilized nervous system. Such types of nervous systems are decidedly on the increase among children of the class that we are called on to treat. Hence, the increase in this kind of malocclusion.

Let us analyze these casts (Fig. 1) with a view toward proper treatment of this case. First, how do we know that this is a Class I case with the teeth on the sides of the upper arch mesial, rather than a Class II case with the lower teeth distal?

In order to understand the points of differentiation, I would first state just what constitutes a Class II case. This is a case in which the body of the lower jaw, together with the lower dental arch, is in distal relationship to the general skull structure. This is usually indicated by the cusp relationship of the upper and lower first molars, but not always, for here is a case in which the lower dental arch and body of the mandible are not in distal relationship to the skull, although the cusping of the molars would lead you to that conclusion.

What means have we for distinguishing between the two conditions?

1. The angle of inclination of the cuspids. In the vast majority of types of individuals that are living in America, the mesial inclination of the upper cuspid is not very marked. In other words, the crown of the cuspid is but slightly mesial to the apex of its root. The upper third of the root of the upper and lower cuspid teeth is a stable point in denture anatomy. Consequently, when we see the upper cuspid in exaggerated mesial inclination, we may at once suspect that there has been a forward shifting of the crown of the teeth on this side of the arch. Sometimes, the inclination of the first bicuspid also verifies this.

2. The size of the body of the mandible. A mandible whose body is in distal relation to the skull exhibits a decided undergrowth of this portion of the bone. (Fig. 2.) That is just why it is distal.

3. Strang, R. H. W.: Dent. Cosmos, 66:731 (July), 1924.

The condyles are not posteriorly located in the articular fossae. They cannot be or they would be in the ear passages. The body of the bone has not grown because the forces of occlusion and perverted muscular pull have retarded its normal growth. This reduction in bulk will usually show in the plaster cast.

3. The profile photographs. If these show a well developed lower jaw and normally placed chin, and the upper cuspids are in decided mesial inclination, we may be certain that we are dealing with a Class 1 case with mesial shifting of the upper teeth. (Fig. 3.)

4. The etiology. If muscle spasm or perverted muscular pressure can be detected as acting in such a way as to force the teeth mesially it would be reasonable to conclude that they are so. On the other hand, if there is a backward pull on the body of the mandible, one would expect to find this in a distal position.

5. The axial inclination of the lower molars. These teeth almost invariably have a mesial axial inclination when the body of the mandible has been retarded in its growth.

6. The bite is usually "closed" and the "curve of Spee" is quite exaggerated when the body of the mandible is undergrown. This would indicate an undergrowth in the vertical dimension as well as in the forward one.

Thus, we see that there are a number of indicators whereby we may be able to come to a correct conclusion as to the tooth and jaw position. Of course, there are a few transitional cases that it may be difficult to analyze correctly, but a mistake one way or the other in these will do but little harm. It is quite a different thing when a mistake is made in a well-established deformity.

When we meet with a malocclusion in Class 1 in which the upper teeth are mesial to normal, proper treatment necessitates the distal movement of the upper molars, bicuspids and cuspids, and sometimes the lingual tipping of the incisors, although usually these are not displaced labially. The lower teeth must be held in as nearly absolute stationary anchorage as possible. All these various changes and requirements can be taken care of by the ribbon arch mechanism very efficiently. In the upper arch, the tubes on the molar bands are alined so that the anterior portion of the arch will lie about one-quarter inch above the gingival border. All the six anterior teeth carry bracket bands. Those on the cuspids have the so-called horizontal springs, auxiliaries for tipping these crowns distally. (Fig. 4.) If it is indicated, the arch is lingually torqued so as to tip the incisor crowns in the desired direction. There are also hooks for intermaxillary elastics.

On the lower arch, the strongest of stationary anchorages is used, as no growth or forward shifting of these teeth is desired. Thus, all the movements necessary will be carried on at the same time and rapid progress made in the treatment of a difficult case. (Fig. 5.)

Group 2 comprises cases in which there has been a mesial shifting of the teeth in both arches. (Fig. 6.)

Analysis of the tooth position in this case shows that the molars and bicuspids are correctly articulating on each side, but there is a decided mesial axial shifting of both the upper and lower cuspids. This can only occur from a mesial malocclusion of the lateral sections of the upper and lower arches, and consequently they must be put back if this type of case is to be correctly unraveled.

This is the most difficult combination of tooth movements that the orthodontist is called on to make, and yet it can be

done very satisfactorily with the ribbon arch mechanism. The adjustment of appliances on the upper arch is just the same as in the preceding case, but on the lower, instead of using stationary anchorage, we make an application of the mechanism that simulates the upper, and thus get a distal tipping force on both arches. The elastics can be used to start the upper, but should be discontinued as soon as possible to allow the lower to move more rapidly. If possible, bracket bands with horizontal springs should be placed on the lower first bicuspids, as these will add considerable power to the distal action of the lower appliance. Figure 7 shows the result obtained in the treatment of this case.

Group 3 consists of cases in Class II, Divisions 1 and 2, with their subdivisions.

For some years, there has been considerable controversy between two classes of operators relative to the proper way in which these cases should be treated. Both groups believe that the lower jaw and dental arch occupy a distal position to normal in the skull, but they differ quite radically in the method used to restore this faulty area to as nearly normal relationship to the rest of the head as is possible. One group teaches that the teeth in both jaws should first be correctly alined in their proper arch form, and then the patient should be trained to bite forward and to exercise and masticate in this position, contending that this will eventually establish the normal relationship of the lower arch. The other group believes that it is hopeless to try to obtain a permanent forward position of the mandible by shifting the condyles forward on the eminentia articularis, for they will always slide back when the patient is not exerting a voluntary effort to maintain their false position. Instead of doing this, they say that the operator should move the upper teeth distally until normal incline plane relationship is obtained, though a temporary deformity is produced in the upper jaw by so doing. Then the patient should be taught how to use the lips and cheeks normally, and the masticating muscles vigorously, to start normal growth in the body of the mandible, which will gradually carry all the teeth in both dental arches into correct relationship with the other structures of the head, thus overcoming the deformity in each jaw.

Now let us analyze these two methods of treatment and see which has the greatest possibilities for success. We certainly are dealing with an undergrowth of the body of the mandible and not with a distal displacement of the condyles. Therefore, the body must be made to increase in bulk from the distal edge of the rami to the symphysis and from the lower border of the body to the upper part of the alveolar process. This can be accomplished only by reestablishing the normal forces of occlusion and thus by functional activity stimulating the bone cells. When the temporomaxillary articulation, with its ligaments and powerful muscle associates, is placed in a false and unbalanced position by throwing the jaw forward, the physiologic lines of stress are so markedly upset by this method of obtaining normal incline plane relationship that there is little chance of producing the stimulating growth forces that we so greatly need. Too much power is being expended in the effort to hold the condyles forward and not enough in pounding against the occlusal surfaces of the teeth. Therefore, there is a division of labor, as it were, with one group of forces working against the other. Physiologic forces are not being harmonized to gain the desired result. When the upper

teeth are moved distally in order to obtain correct incline plane relationship without disturbing the temporomaxillary articulation and its associated structures, we are simply going back a few years in the patient's life and placing his teeth nearly where they were when things went wrong, and then teaching him how to use the power plant in such a way that these faulty years will be rapidly spanned and as much normal growth obtained as is possible under the handicap of imperfect and somewhat artificial function. But in this method there are no antagonistic forces at work other than those concerned in the etiology of the original deformity. The condyles are in their proper anatomic positions and the ligaments and muscles are under normal stress and working along natural lines of pull. Furthermore, after the period of active treatment is completed, if proper mechanical retention is used, such as inclined planes on the lower cuspids, the tendency of the upper teeth to return to their natural positions becomes an important adjunct in effecting a forward movement of the lower teeth and a proportionate growth in the bone of the mandible to support these. So we find harmony and balance in the forces now at work to restore the size of the body of the mandible, and it is reasonable to expect that better results will be obtained from such a plan of treatment than from one in which there are strong counteracting and antagonizing forces in action.

Those of us who have seen the results of both kinds of treatment have not the slightest doubt that the latter procedure is the one that gives the best and most lasting results. It does not always produce full development of the mandible with the lower arch in its normal relationship to the skull, because we are not always able to obtain balanced muscular action and so overcome the distal pull of the muscles on the mandible; but even in these cases, cusp relationship can be maintained at normal, and there is never the deformity that the two bite treatment almost invariably exhibits when the patient allows the condyles to take their natural position.

The ribbon arch mechanism is ideal for the treatment of this group of cases by the latter method. On the upper arch, the molars can be tipped distally and elongated as the incisors are carried lingually and shortened.

In the lower arch, stationary anchorage is obtained, and the molars in this adjustment can be tipped upright and elongated to open the bite if necessary, and at the same time the incisors can be depressed. Intermaxillary elastics, of course, complete the power used in this tooth shifting.

These three groups of cases comprise the most difficult types of deformities that we are called on to unravel, and place a severe test on the efficiency of any appliance. The ribbon arch mechanism meets the demands of such treatments with a degree of perfection that leaves little to be desired; yet (may I again emphasize?) this is not an automatic worker, but needs skilled and highly trained hands to direct its activity and a well educated brain to interpret the normal laws of tissue metabolism, without the knowledge of which no operator can be either safe or successful. Given this combination of assets, the orthodontist may confidently employ this appliance in any case, simple or complicated, and rapidly obtain the desired result with practically no discomfort to the patient nor danger to the oral tissues.

SUMMARY

1. The ribbon arch mechanism conforms to the physiologic requirements of a tooth-moving mechanism.

2. Its mechanical principles are correct.

3. It affords one more power force than any other appliance except the "newest mechanism," i. e., the torque force.

4. It can be successfully used in the most difficult types of malocclusions in which nearly all other appliances fail to a greater or less degree.

5. It can perform more tooth movements of various characters at the same time than any other appliance, and thus greatly shorten the period of treatment of a case.

Many have hesitated to use this appliance because they have been told that it is a tissue destroyer. You may rest assured that it is not the appliance that has been at fault if destructive processes have appeared, but rather the character of the tooth movements produced by faulty adjustments at the hands of unskilled operators. This mechanism is bound to move the teeth, and if the arch bends are made in the wrong direction and are of an excessive amount, then the resulting tissue changes are disappointing and even alarming.

If the operator studies this appliance by using the technic models as suggested, he can soon acquire such familiarity with its adjustments as to be able to apply it to all cases with safety, intelligence and success.

Modern orthodontia is demanding results such as this appliance and the "newest mechanism" alone can give. Therefore, no sacrifice of time and effort is too great to perfect one's self in the efficient use of these two appliances.

886 Main Street.

THE NEW ANGLE MECHANISM*

By ALLAN G. BRODIE, D.D.S., Newark, N. J.

BY way of introduction, I wish to say that this is the first time that the newest Angle mechanism has ever been presented before any group except the Edward H. Angle Society. It was presented, in its present form, before that group in February, 1926. Prior to that time, it had been used in the Angle School in Pasadena and by several men in private practice for over two years, after five years of experimental and refining work by Dr. Angle. Therefore, the best part of ten years has been spent in bringing it up to its present state of refinement.

In view of the fact that so little has been published on the subject, and that so recently, I have been very much at sea as to how to best present it so that you may most readily grasp the mechanics of the appliance and the reasons for its introduction. I have finally fallen back on the schoolmaster method of approach, and shall endeavor to lead you, step by step, through some of the problems of orthodontia, our point of view of these problems, the philosophy behind our

* Read before the Section on Orthodontia at the Midwinter Clinic of the Chicago Dental Society, Jan. 15, 1929.

treatment and the actual mechanics employed.

It has been said by every orthodontic authority that in order to understand the abnormal, we must first understand the normal. All that we know about normal lies wrapped up in the fundamental sciences, among which are numbered biology, embryology, cytology, anatomy, physiology, histology and comparative anatomy, and unless the orthodontist is thoroughly familiar with these subjects as they relate to the head and neck, he cannot claim to be conversant with the little that is known.

All scientific orthodontia must start from these sources, and every new theory or hypothesis should be checked with them before being adopted. Unfortunately, this is not always done. Many apparently plausible ideas would never see the light of day if their authors had stopped to do this, because there is quite often a wide jump from plausibility to truth.

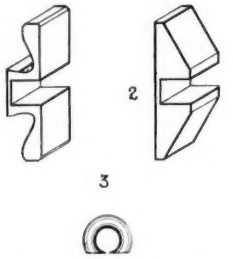

Fig. 1.—Parts of the newest Angle mechanism. *1*, the tie bracket; *2*, the alinement bracket; *3*, the alinement staple.

Each group in orthodontia today claims that its foundations are laid in the sciences, and yet the methods of treatment growing out of these foundations have reached such diametrically opposed points that it is apparent at first glance that they cannot all be equally correct. Somewhere, some of them have either failed to progress or have left the trail; while others may have built their premises on false hypotheses. That is, of course, granting that one of them is correct, which is not at all certain.

I have long felt that it would be a very desirable thing if the various groups, now so widely separated, might in some way be brought together to discuss, not appliances, but fundamentals. On these things and on the lessons that they teach, we should all be agreed, if our specialty is to retain the proud place it now holds. Behind every appliance ever invented, there is a philosophy, and if that philosophy is wrong, so is the appliance. If you wish to test the accuracy of this statement, take two men who use different appliances and set the same case

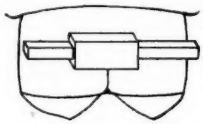

Fig. 2.—Molar band carrying one-half of a tiny rectangular tube, soldered in an edgewise direction.

before each of them. You will be surprised at the wide divergence of their views, both as to analysis and as to the method of treatment to be employed. This happens so consistently that it brings to mind the question as to whether or not analysis is not too often made subject to the possibilities or limitations lying within a certain appliance.

This is not as it should be. Regardless of what we know about limitations or possibilities of results, we should keep ever in mind the ideal for each particular case as far as our understanding of the normal will permit. Failure to do this will soon leave us hopelessly mired; whereas, a constant striving for an ideal

will provide impetus for greater and greater strides. If we once gain a clear conception of our problems, we shall find ways to solve them. Man is like that.

I am therefore going to try to lay before you our thoughts about the denture and the ideals toward which we are striving, so that you may more clearly see the reasons for the introduction of the "newest mechanism." I hope that you will carefully check everything that I say and discuss it fully once it is stated. It is only in this manner that we can hope to see each other's points of view and decide on that which we will embrace.

THE NORMAL DENTURE

If we were asked to pick out a single word that would best describe the majesty and dignity of the human denture, that word would have to be "balance." The more one studies the human makeup the more he is impressed with nature's effort to preserve this quality in all that she does. From the individual shapes of the teeth, their inclined planes, their interdigitation and contact points; through the makeup of the pericemental membrane, alveolar bone, bone in general and musculature, we see each tiny detail working toward this great ideal; and it must be remembered that this balance goes a great deal deeper than these simple macroscopic manifestations. Anatomy leads us easily into histology, and under the microscope, we are taught the same lesson over again. To dip still deeper, we go into cytology and study the individual cell, and to understand this, we find we must enter the realm of biochemistry; and so it goes. But no matter how deeply we become involved, the lesson is the same: balance.

Fig. 3.—Ideal arch forms, upper and lower.

We further learn that this balance is not of the static variety. It is dynamic in character, i. e., it is the result of a vast number of forces of various kinds playing against each other. A disharmony between any of these forces inaugurates immediate changes, resulting in new balances that may work to the individual's detriment or even lead to rapid degeneration. This shifting of balances has been one of the mainsprings of evolution, and it is also the sole excuse for the existence of the doctor, the dentist and the orthodontist. A matter of such grave importance should be understood by all these men.

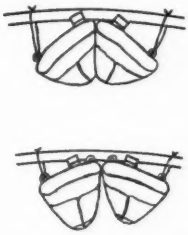

Fig. 4. — Manner of placing alinement brackets and staples for rotations.

Any of the tissues with which we deal exhibits this phenomenon in a thousand different ways. I am going to select only two to comment on. The first is bone, the second, muscle. As to bone in general, few seem to realize what a pliable material it is. There is a tendency to picture it as we see it in a museum specimen: hard, brittle and unyielding except under long continued pressure. It might

more aptly be compared to a piece of taffy. Its very function demands that it be adaptable to all the changes in stress that work upon it; that is, if its bulk is to be kept within economic limits; and, as you know, Nature has no use for a surplus of anything. Alveolar bone in which you and I are mainly interested, is transitory in nature. It develops with and for the teeth alone, and is absorbed when they are lost. Its formation and degree of development depend on function acting through the teeth and pericemental membrane. Any change in stress on a tooth is immediately transferred to the spicules making up this bone, which is cancellous in structure and easily modified. It is in this bone that any necessary adaptation first takes place to withstand the strain of the new conditions.

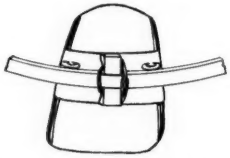

Fig. 5.—Tie bracket applied to a tooth not needing rotation. Note staples.

So we see the teeth set in a base that is easily modified, and they are maintained in their correct relationships by an equilibrium of the various forces that play on them. The greatest of these forces is probably the musculature. On the inside, we have the tongue, supporting the lingual surfaces and imparting to their arrangement its own form. On the outside, we have a wide band of muscle tissue beginning distally from the last tooth and traveling around the arch. The combined forces of these two muscle masses would be sufficient to maintain the correct relation of the teeth were it not for the dynamic forces of growth and function.

The human being grows so slowly and adapts himself so quickly to changes in his environment that we have accepted an ideal of normality without realizing the multitudinous adjustments that the body must make in its evolution from infant to adult. It is only comparatively recently that the anthropologist has shown us the vast difference between the infant and the adult, especially as regards the head. Prior to this, it was tacitly considered that the child was much the same as the man except in bulk. This we now know to be erroneous. Recent investigations have shown us that growth is probably a continuous series of changes in the balance of the denture which cause a shifting not only of the sites of actual growth, but also of the bulk of the denture. It has long been felt that there existed a definite relation between the cranium and the denture, and if the orthodontist is to hope for permanent results, he cannot ignore this point.

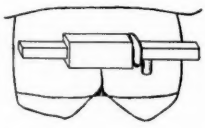

Fig. 6.—Spur and ligature method of lengthening the arch.

The investigations that have been undertaken to discover a landmark that would act as a guide in determining this relation have so far failed. I believe that they will continue to fail for the reason that the denture is placed and held in its correct position only by an equilibrium of the various forces that act on it. This position changes constantly, owing to the shifting of balance that is

caused by changes in relation between the various forces. The whole problem is very complex and at first glance seems hopeless, but the so-called unscientific observations and work of the man at the chair have gone a long way toward solving the riddle, as far as logical treatment is concerned. Let us examine for a moment his observation and the method of his approach.

The buccal muscles, composed almost exclusively of the buccinators, have as a posterior attachment the pterygomandibular raphé, a dense band of connective tissue running from the hamulus of the internal pterygoid plate to the distal end of the mylohyoid ridge on the inner surface of the mandible. Thus, the buccinator must cross the alveolar ridges in order to gain its main attachments on the buccal surfaces of the maxilla and mandible. This same raphé acts also as the anterior attachment for the superior constrictor of the pharynx, superior fibers of which end on the basalar portion of the occipital bone, the remainder of the fibers ending in a median raphé that is part of the cervical fascia, originating at the vertebral column. If we stop to analyze this, we find that the denture is entirely surrounded by a wide elastic band of muscle tissue whose obvious tendency would be to draw the denture distally.

Going to the mandible, we find attached to it four pairs of muscles that are fastened well toward or at the symphysis, all running backward and downward. So here we have another distal tendency. In addition to these two groups, practically all the muscles contributing to the makeup of the lips have a posterior origin. With all this evidence before us, we would naturally ask: "Why do not teeth move distally with all this force on them in that direction?" The answer is not simple, but the evidence is daily getting clearer.

There is an inherent forward force in the human denture, placed there undoubtedly to counteract the forces that I have enumerated, and to thus keep the denture in a state of dynamic equilibrium. What this force is, we do not know for certain. Dr. Strang was, I believe, the first to call attention to it.[1] At that time, it was looked on as a symptom of a tenseness of the nervous system, but since then, with more evidence at hand, it has been found that it is common to all dentures, although to a somewhat lesser degree. Two of the more recent probable factors advanced are, first, the "balling-up" of the muscles lying

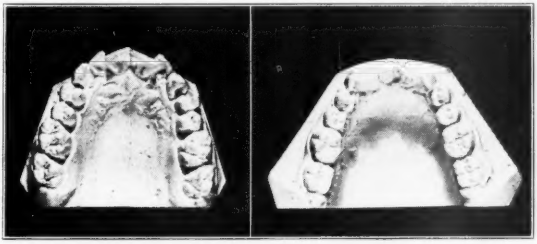

Fig. 7.—Simple Class I case calling for slight expansion and rotation of the incisors.

1. Strang, R. H. W.: Dent, Cosmos, 66:731 (July) 1924.

posterior to the pterygomandibular raphé and buccinator muscle during function, and, secondly, the forward squeezing action exerted on the buccal teeth by the function of the masseter and internal pterygoid muscles. But regardless of causes, if you doubt the existence of such a force I would ask that you consider the following facts: Why do buccal teeth always drift or tip forward, if they get a chance, through a break in the arch? Why is it that we see so many cases of teeth that are patently too far forward, and yet no one ever saw a case in which, if the teeth were of normal size, the denture was set too far distally? Why is it that so many orthodontic cases, especially in the old days when treatment consisted of leaving molars alone and merely expanding until alinement was gained, ended up with a "toothy" appearance? All of these point to the fact that there is such a forward force that must always be reckoned with. This force, which acts on the formed as well as the growing denture, we call, for want of a better term, the anterior component of force.

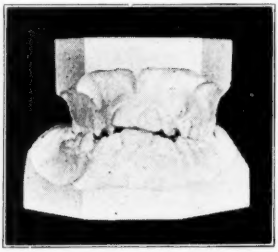

Fig. 8.—Front view of a Class I case wherein the upper right buccal teeth were in lingual occlusion.

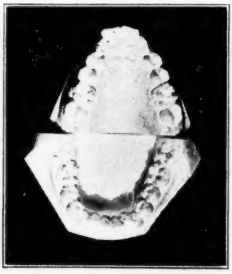

Fig. 9.—Occlusal view of case shown in Figure 8.

Another force acting in the same direction, but on the bases of the denture as a whole, and only during the growth period, is the growth force. Here again we must refer to the recent findings of the anthropologists. It was formerly thought that all growth took place about evenly in three planes of space, and that as far as the maxilla was concerned, it was in a downward, forward and outward direction, and in the mandible in an upward, forward and outward direction. This process does take place up until the deciduous teeth have taken their places and have spaced. From this point on, there seems to be little change in this portion of the arches, but growth takes place at different points to gain the space necessary for the three molars. These points are the posterior surfaces of the rami of the mandible, where bone is laid down on the surface coincidental to an absorption of the anterior border. In the upper jaw, we have a posterior growth of the palate and alveolar ridges.

Now you can readily see that this amount of backward growth would involve a serious infringement on the territory demanded by the pharynx. Nature takes care of it by causing a downward and forward movement of the whole facial mask so that it is in reality swung into an entirely different relation with the cranium. How foolish it is, then, to take a point on the face to compare with a point on the teeth, when not only one

but also both points are swinging in an arc.

If we accept these things, we find that there is this additional forward force operating on all dentures in which the orthodontist has an interest; and, as has been stated, the musculature of the lips, pharynx and cheeks contribute the only force antagonizing these forward tendencies. As long as they all balance, we shall have a correct relation existing between denture and cranium; but let anything disturb this balance and things happen pretty rapidly. Take, for instance, the premature loss of a deciduous cuspid, or a buckling of the anterior portion of the arch; in short, anything that deprives a

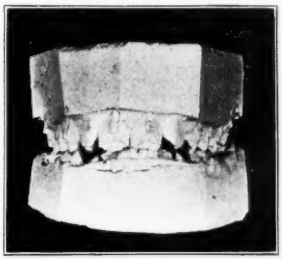

Fig. 10.—Same case as that shown in Figures 8 and 9 after a month and a half of treatment, showing upper right teeth in normal buccolingual relation.

tooth of the support of its neighbors through the contact points, and we immediately have a loss of balance. We may or may not have a backward movement of the incisors; we always have a mesial drifting of the buccal teeth on the affected side, owing to the unantagonized force of the anterior component.

This drifting may be confined to only one jaw or it may directly or indirectly involve both jaws. In the latter case, we eventually have a bimaxillary protrusion, one of the most baffling of all orthodontic problems and one which, until recently, was untreatable except in a very unscientific and unsatisfactory manner. Proper treatment calls for the setting back of all teeth in both jaws if we hope for success. It is possible to do just this with the ribbon arch, but Dr. Strang is the only man that has ever succeeded in doing it with this mechanism, as far as I know. The new Angle mechanism offers a far easier technic for the same purpose.

Another problem, and one which is receiving a great deal of attention at present, is infraclusion of the molar region, and the excessive overbite. Judging from

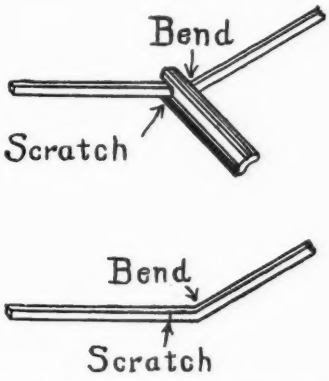

Fig. 11.—Arch bender in position for the molar bend and the arch after bending.

current literature dealing with these two conditions, they are both very obscure as to etiology, and both very difficult to treat. All sorts of probable causes are advanced, from endocrine disturbances to faulty diet, and all sorts of treatment is prescribed, from the onlays on the molars to the bite-plane anteriorly. There is plenty of evidence in the fundamental sciences to give us clues in our approach to these problems without even considering these hypothetical causes.

I had the good fortune to be able to examine the skull of a Flathead Indian some time ago. This tribe, as you no doubt know, followed the custom of strapping the heads of the young between boards, in order that they might conform to their idea of beauty. In the particular specimen that I examined, this practice had forced the dental arches into a full Class II relation. However, the mandible was massive and well formed, and the jaws, taken individually, were well nigh perfect in tooth alinement, arch width and alveolar bone development. Contrast this, if you will, to the clinical picture we have of the Class II case with its narrow arches, its sharp

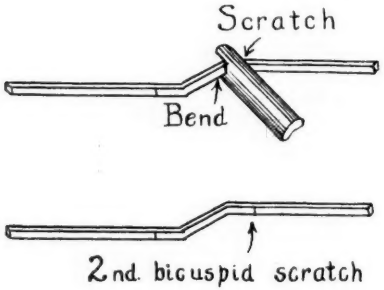

Fig. 12.—Arch bender in position for the distal second bicuspid bend and the arch after the bend is made.

curve of Spee, its overbite and its molar and bicuspid infraclusion.

This aborigine, like all others, exhibited the typical worn cusps. The mandibular arch could be swung into any position on the maxillary arch and would scarcely show daylight between the masticating surfaces or the incisal edges. The glenoid fossa told the story of this individual's fight against his deformity. It was almost as flat as the palm of a hand, permitting function in a Class I relation on the harsh diet that was his. He had risen above his handicap and had used his teeth as they were designed to be used and there was no so-called lack of vertical development and no supraclusion.

It must be remembered that there are two main forces which bring bones to their normal shape and size. The first of these is heredity, which we cannot change; the second is function, which we can very materially assist or improve. Heredity lays down the architectural plan of the bone, and function determines the form and degree of development. In other words, it is our contention that the mandible of the Class II case is not, as is so generally thought, mysteriously stunted in growth: it is developed fully

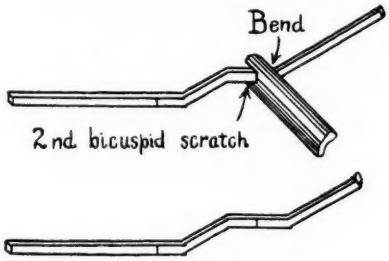

Fig. 13.—Arch bender in position for the mesial second bicuspid bend and the arch after the bend is made.

up to the function that it is called on to perform under civilized conditions of life. The fault lies, not in the endocrines or the diet, but in underfunction, and it is our duty to see that this function is restored as soon as possible. This calls for a reestablishment of normal occlusal relations with the denture as a whole in a position from which it can move only toward normal, i. e., back of its position of balance.

To sum up this material, then, we believe that in every case which we treat we should arrive at normal occlusal re-

lations as quickly as is physiologically possible, and that where there is the slightest doubt as to whether the denture is too far forward, it should be carried back to normal and beyond, if possible. It goes without saying that all etiologic factors, such as muscle or sleeping habits and nasal obstructions, should be corrected and all underdeveloped muscles brought up to par, before we can hope for a successful result.

Leaving the biologic side of the question for awhile, let us consider mechanics. There is a growing tendency to belittle the mechanical side of orthodontia at the present time. It is claimed that mechanics and appliances have obscured the more scientific side of our profession. This has doubtless been true, but let us be careful that we do not let the pendulum swing too far in the opposite direction, as has so often happened in dentistry and medicine. The day has not yet arrived when we can sit at a desk and direct a campaign against malocclusion. As long as we need mechanical aids, we should be ever studying them and seeing that they supply the needs created by the theoretical side of our study. A man may be well informed on the up-to-date points of view of orthodontia and yet be unable to treat a case of malocclusion properly simply because he is using tools that were designed to meet the theories of twenty or thirty years ago.

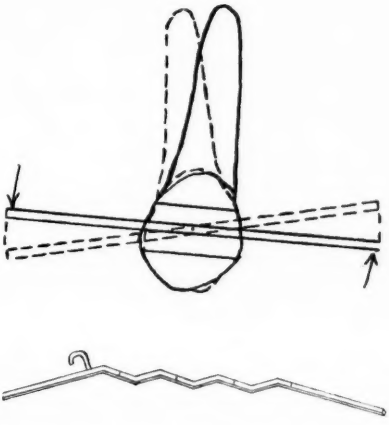

Fig. 14.—Above: Arch after all of the second degree bends are made. Below: Drawing showing the principle of stationary anchorage.

Our conception of the denture and also of the duties of an orthodontist have changed considerably over this period, and we have become more acutely aware of the fact that apparently insignificant things can become potent etiologic factors. Today, we need appliances that will take care of the most minute adjustments, and since the anthropologist has entered our field, we have learned that we can no longer think and work in two planes of space. Nature works in three, and we must do likewise. A mere expansion of the teeth for alinement can no longer be considered true orthodontia; and this brings us face to face with what has always been the orthondontist's nightmare: anchorage. Three plane treatment puts a severe strain on the old forms of anchorage, which are already overburdened. These are a few of the needs that a modern appliance must supply.

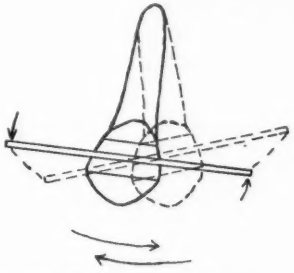

Fig. 15.—"Picket-fence" anchorage. The arch is allowed to travel.

The last need that I shall refer to, but by no means the least important, is a more expeditious treatment of our cases. I am well aware that any question of so-called speed in orthodontia is bound to stir up a hornet's nest in certain quarters, but it is our duty to keep hammering on this point until it is either gained or disproved.

From the very nature of the thing, one would expect the orthodontists to be prejudiced in its favor, instead of against it, and I believe that they will be once it is understood. There are one or two long standing mental grooves that must be eradicated before we can hope for its universal acceptance. The first of these is the question, "How fast can a tooth be moved with safety?" In an endeavor to answer this, we have become accustomed to comparisons with the growth rate, and this has seemed such a plausible and safe criterion that it has become axiomatic. Nothing could be further from the truth nor more unflattering to Nature. Every change in the body must ultimately be reduced to the stage of cell activity; and if we dip into cytology, we find that the various cell processes, such as growth, metabolism and even reproduction, are not dragged out over days or even hours. They are a matter of but a few seconds from inception to close. We have only to think of some of the defense and repair phenomena of the body to realize this. Again, if we persist in comparisons with the growth rates, what period of growth are we going to take? In the first nine months of life, a single cell becomes a human being weighing from 6 to 10 pounds. During this time, we have had not only this great bulk produced, but also our differentiation, first into the three primary germ layers, and then into the multitude of tissues and organs. Why not use this growth for our model?

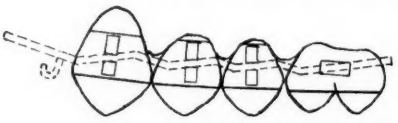

Fig. 16.—Bent arch lying opposite the brackets, showing its relation to them before seating.

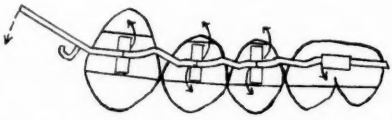

Fig. 17.—The arch seated in the buccal brackets. Arrows show the points and direction of forces on each bracket.

Another thing that has confused us has been our appliances, although we are only now beginning to realize this. With most appliances, from the "E" arch and ligatures down, our force control has been so imperfect and our leakage of power so great that more force was expended by far than is necessary with a modern appliance. We have felt, naturally, that all this force which we were applying was acting on the tissues, and we gradually became accustomed to a slow response. We now know that this was wrong, and that speed depends not on the amount of force, but on the efficiency with which that force is applied. Again, the philosophy behind our appliances has had a potent influence on our point of view. The term "unravelling a case of malocclusion" has been used countless times for the very good reason that this exactly described the treatment. It has been necessary to work out our cases in much the way that one plays chess. One or two teeth had to be taken care of at one time, and then another, and so on, until the last had been moved into place.

Mechanical limitations of the appliances themselves, and a lack of sufficient anchorage, made this necessary. Before the case was completed, changes had been effected in every part of the jaws, but it had been done in sections. I do not think that any logical objection could be raised against doing all this modifying at once, if it were possible to do so. In this manner, an entire case could be taken care of in but little more time than it now takes to treat the slowest responding tooth, or group of teeth.

To the best of my knowledge, there has never been a written statement of the rapid treatment principle made by any man using it, although there has been considerable published against it. Some of the results gained have been so startling that a determined effort has been made to determine whether or not a loss was being sustained in another way, before doing any publishing. Prompt publishing has been held up owing to the lack of any quick method of checking, and it has finally been necessary to fall back on the same methods that now obtain for orthodontia and dentistry in general. These are the roentgen ray and clinical observations as to pain and inflammation, and the permanence of results gained, measured over a period of two or three years after retention.

After nearly five years' work by men of all degrees of skill and experience, the following general conclusions have been reached:

1. Force above a physiologic limit will not only do damage to the teeth and alveolar bone, but will actually slow up the total elapsed time of treatment.

2. Speed and force do not bear a direct ratio to each other as has been thought; that is, an increase in speed does not necessarily mean that there has been an increase in force.

3. The rapid movement of the tooth into its correct position can be accomplished without pain or inflammation and will show a rapid and typical bone regeneration about its root.

4. Speed of movement has no bearing on retention. A tooth that has been moved rapidly shows no greater tendency to revert to its former position than one slowly moved.

5. The greater the number of teeth banded, the more rapid the response. This is undoubtedly due to the vast increase in our anchorage and to the fact that we have instant and complete control over each individual tooth.

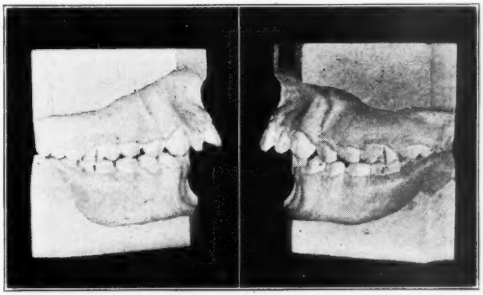

Fig. 18.—Right and left views of a Class II Div. 1 case.

6. Long unsupported spans of arch wire, such as have been common in the past, are not only dangerous, but mechanically inefficient as well.

7. It is safe and physiologically correct to let teeth move just as rapidly as they will on application of a gentle but firm force working in one direction only, i. e., without backplay.

8. Each individual case must be a law unto itself in the amount of force applied. In a slowly responding case, we use less force and allow it to work over a longer period of time.

Now let us consider the appliance. I have tried to outline the problems that it was designed to meet.

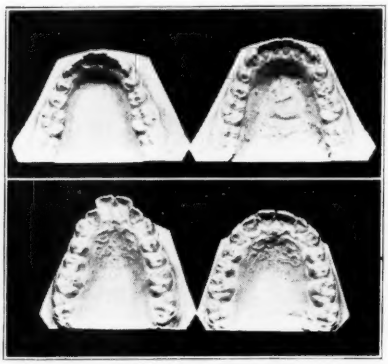

Fig. 19.—Comparative upper and lower occlusal views of the case shown in Figures 18 and 20, before and after treatment.

THE APPLIANCE

The mechanical makeup of the "newest mechanism" is easy of comprehension to all who have ever used a bracket band. The bands come equipped with two types of brackets and are 1¾ inches in length, one-eighth inch in width and four-thousandths of an inch in thickness. (Fig. 1.) The bracket shown at *1* is called the tie bracket, and that shown at *2* is known as the alinement bracket. Both present the slot for the arch in a labial or buccal direction, but the tie bracket is equipped with flanges for the reception of a ligature, while the alinement bracket tapers as a solid block from the center toward the gingival and incisal edges. The tie bracket is capable of holding the arch while it works, while the alinement bracket is purely a working bracket and needs an additional attachment for the retention of the arch in the slot.

The attachment shown at *3* is called the alinement staple, and is nothing more nor less than a gold eyelet with flat feet, which may be soldered to the band in any desired position. Its lumen or bore will accommodate any ligature up to and including 0.015.

The molars are equipped with the clamp band preferably, and the buccal attachment that receives the arch ends is one-half of a tiny rectangular tube, measuring one-eighth inch over all. It is soldered to the band in an edgewise direction. (Fig. 2.)

The arch material is supplied in strips and is cut to measure by the operator. In cross-section, it measures 0.022 by 0.028 inches. It differs from the standard ribbon arch in width, in the fact that it has square corners and in that it is applied to the teeth in an edgewise direction. Furthermore, the method of its handling is vastly different. We do not bend it to follow and engage the brackets; rather, we entirely disregard the brackets and form it into what we consider to be the ideal arch form for each particular case. This is determined in two ways: (1) by a series of measurements and (2) by a study of the face, cranium and tooth forms of the patient in question. The latter rests entirely with the operator and must not be considered as even remotely resembling Bonwill's triangle. It

is merely a working guide to which we adhere throughout treatment. A brief description of this will suffice here, as the procedure will be accurately demonstrated later. (Fig. 3.)

In the six anterior teeth, we are following a plan that is new to orthodontia. This is the setting back of the lateral incisors. It not only gives vastly improved esthetics to the case, but it is physiologically correct, as proved by a searching study of a large number of normal dentures. A person biting into a thin piece of wax may produce incisal edge marks that form a true arc from cuspid to cuspid; but if we examine these teeth at the gingival border, we find that the cuspids as the width of these teeth. The arch emerges again at the mesial side of the cuspids and follows the contour of this tooth to the eminence; and from this point, it runs in a straight line to the eminence on the mesiobuccal cusp on the first molar. Here, it bends slightly lingually and follows the course of the molars. In the lower jaw, the arch runs in an even arc from cuspid eminence to cuspid eminence, and from here back it follows a straight course to the molar, where it bends in the same manner as in the upper.

The arch may be made square, ovoid or round by increasing some of these

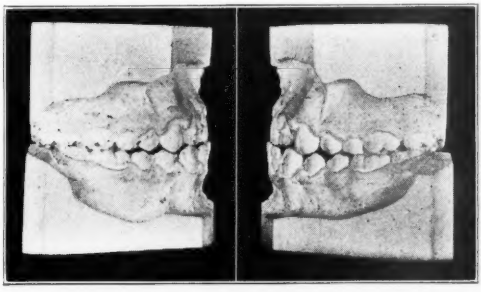

Fig. 20.—Case shown in Figure 18 after four months of treatment. The amount of overtreatment may be noted.

are most prominent, the central incisors next and the lateral incisors farthest lingually. The reasons for this are twofold: (1) the difference in thickness of these teeth at the neck and (2) the difference in their axial inclinations.

So our mechanical arch is formed, with the aid of measurements, to travel over the central incisors in an even arc, and this arc is the length of the combined width of these teeth. At the distal side of the central incisors, it dips slightly lingually and travels over the lateral incisors, and this distance is made the same bends and decreasing others, and this is done according to the operator's idea of the requirements of the case. When we finish, we have an arch that is not only accurate in the proportions of its various parts, but also conforms to the type of the individual. We call this the ideal arch, and it is strictly adhered to throughout treatment, any distortion being immediately corrected. In this manner, we have the advantage of both the expansion arch *E* and the ribbon arch, and we have others that are peculiar to this mechanism alone, as will be shown.

To get the most out of this appliance, a thorough study and analysis of our case is indispensable before we do a tap of work in the mouth. On this analysis depends the correct application of the appliance which, in turn, is going to determine the efficiency of the mechanics employed and the length of treatment. Before doing anything, we must study our models, photographs and roentgenograms, with a view to determining the following points: 1. Are either or both

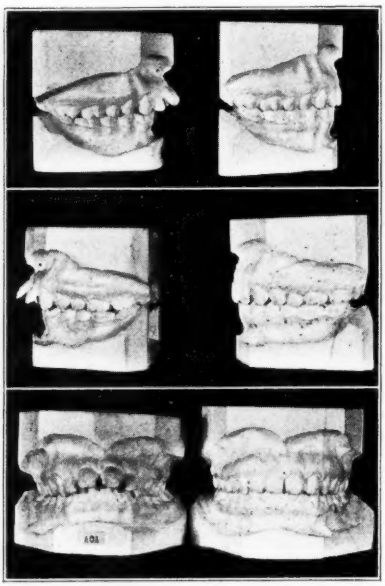

Fig. 21.—Right (above), left (center) and front (below) comparative views of a Class II Div. 1 case before treatment and eighteen months after the retention apparatus was removed.

of these arches going to need expansion? 2. What teeth are going to need rotating? 3. What type of arch does this case call for? 4. What changes, if any, must be made in the relation between dentures and cranium?

With these points determined, we start by banding every tooth in the mouth except the second molars, and even these are sometimes banded. The molars carry clamp bands and all the rest carry one or the other of the bracket bands, this depending on the kind of control that we desire over the tooth in question. These bands, like all other bracket bands, should be placed over the middle third of the tooth and at right angles to its long axis. The bracket, however, unlike that of the ribbon arch, need not occupy a position directly in the center of the surface, but it may be placed either mesially or distally to this position. (Fig. 4.) When a tooth needs a great deal of rotation, we use an alinement bracket and place it near the corner upon which we desire the tooth to pivot, while the corner that will swing in an arc is equipped with a staple, for the reception of a ligature. Where a slight amount of rotation is desired, the bracket is made to occupy a position just off center toward the rotation point and a staple is placed at both sides. All teeth not needing rotation carry a tie bracket band, and in the incisors these also are equipped with a staple on each side. (Fig. 5.) Once these bands are cemented to the teeth, we can dismiss all thought of appliance work from our minds for the full duration of treatment. With the exception of routine arch adjustment, we are ready for any exigency that may arise.

The application of the arch to the teeth is simplicity itself. Having formed it up to our ideal for the case, the smooth arch ends are slipped into the buccal tubes and through them until the most prominent of the incisor brackets come in contact with the arch. Then, starting at the midline, we ligate left and right alternately as we go distally, until all the teeth are tied to the arch. No effort is

made to force the brackets to engage the arch if they are out of alinement or if for any reason they do not do so easily. If there is considerable malalinement so that the metal arch would be too prominent to be comfortable for the lips, we precede the square arch with one that is round and but 0.022 inch in diameter. This is so light and resilient that it will readily draw into the brackets and act for a long period of time. When it can be applied easily, the square arch is substituted. This is the primary application and precedes all treatment.

Since we band all teeth and since every bracket engaging the arch provides us with stationary anchorage, it follows that, as soon as the last ligature has been tied, every tooth is moving toward its correct position. Furthermore, each tooth is not only moving but also is assisting every other tooth to move by contributing its share of the anchorage. The brackets and staples give us complete control over each individual tooth, so that while mass movement is taking place, the individual teeth can be rotated, tipped, elevated or depressed. In short, orthodontia with this appliance ceases to be a chess game and becomes a molding process in which everything is carried on simultaneously.

Another point wherein this appliance differs radically from any other is in molar attachment. Gone are the bulky tube, the screw and the nut, and in their place we have one-half of a tiny rectangular tube. When seen for the first time, it seems absolutely inadequate for the work it has to perform, and indeed it would be with any other theory of treatment than that underlying this appliance. This theory treats the molar as just another tooth. It is no longer dignified to such a position that successful treatment depends solely on it. Any movement of these teeth that is found necessary takes place coincidently with other tooth movement. Contrast this state of affairs, if you will, to that of all those cases in which a loose molar meant overstrain and a consequent cessation of work until it tightened up. In practically all other appliances, all strain comes eventually to rest with the molars, and on these teeth depends the success or failure of every case. This has been the orthodontist's most hideous "mental hazard," but it need be so no longer.

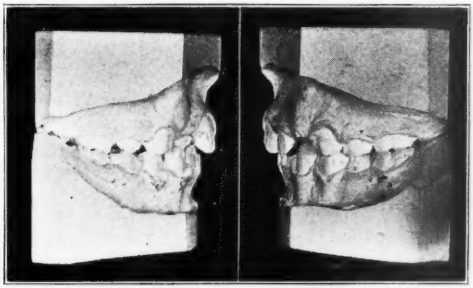

Fig. 22.—Class I case calling for Class II mechanics. All buccal maxillary teeth must be moved distally.

In those cases in which we need an actual lengthening of the arch to create spaces for unerupted or badly malposed teeth, a stop is soldered to the arch at the point where it enters the molar tube. To

gain further space without removing the arch, we slip a heavy wire ligature between the stop and the end of the tube. This can be done three or four times without removing the arch and resoldering the spur to a new position. (Fig. 6.)

With this appliance, teeth may be moved in any direction, individually or *en masse;* all teeth in both jaws may even be moved in the same direction simultaneously. Any group of teeth can be played against any other group, and we can reverse the direction of our anchorage at any point. Torque, with all the advantages pointed out by Dr. Strang, is available in this mechanism the same as in the ribbon arch. Furthermore, there is practically no lost motion. The arch, being very resilient, will operate over a long period of time, and yet the spans between the teeth are so short that "jiggling" or backplay is reduced to a minimum, being less than in any other appliance.

All these factors combine to give us the greatest speed yet known to orthodontia, as far as total elapsed time of treatment is concerned. The appliance permits of such delicate and accurate adjustment that cases are more thoroughly finished than has been usual in the past. This, in turn, will give a greater number of true successes, for it should be remembered that every detail neglected or left to Nature is an invitation to relapse. A rotation here, a poor axial inclination there, are things that are too often overlooked; yet heredity or faulty cooperation is usually blamed if something goes wrong.

And now may I recapitulate the points I have tried to stress: As a preliminary, I have endeavored to present our ideas on the relation of the denture to the cranium, and the reasons why this must ever be borne in mind. Next, the point was stressed that since orthodontic theory was changing, we must expect to see a change in appliances, and that we should demand the utmost in efficiency in anything that we choose to use. This led up to and explained the reasons for the introduction of the "newest mechanism," since this appliance seeks to answer the questions raised by the investigators. Speed was then touched on, and I hope you may have gained a new point of view on this important question.

Last of all, I have described the various parts that go to make up this mechanism, how they are applied and the manner in which they act. On this phase, only the primary adjustment of the arch to the teeth has been given. The clinics that are to follow will make you conversant with the physical makeup and assembly of the appliance, and then the

Fig. 23.—Occlusal view showing lower teeth to be very nearly normal and the upper with occluded cuspid spaces.

manipulation of the arch for all the various forms of treatment will be considered.[2]

TREATMENT

Before taking up the treatment of specific cases and types of cases, it might be well to emphasize certain underlying principles that are common to the treatment of all cases when using this newest mechanism. The first of these is the ideal arch form.

There are three types of bends made in this arch, and each type takes care of treatment in a single plane of space. They are called first, second and third degree bends. The first degree bends are all in the horizontal plane, and are those made in forming the ideal arch. These bends, unlike those of the second and third degree, are never changed once we have determined the form that we wish to give the dental arch in question. Failure to observe this rule strictly will invariably lead to trouble. If we are using an arch that calls for modification during treatment, we shall find it difficult to resist the tendency to modify the arch in order to make it embrace the brackets. Just as soon as we do this, we are throwing overboard the main principle of this appliance; and used in this manner, it is no more efficient than any other. It must also be remembered that we are dealing with an unannealed arch, and that the first degree bends are made in an edgewise direction, as you have seen. Too much bending in this direction not only destroys the working qualities of the metal but also gives us an unknown quantity in the form of temper. So if the ideal arch form is at too great variance with the dental arch for the square material to be comfortable, we should precede it with a round arch of 0.022 inch diameter. This must also be bent into an ideal form. This is the only safe way around the obstacle and is very desirable in a great many cases.

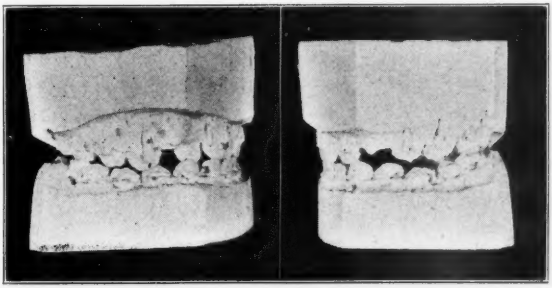

Fig. 24.—Case shown in Figure 23 after two months of treatment. The buccal maxillary teeth are back.

The next fundamental principle to complete success is the banding of sufficient teeth. Here again, the use of other appliances will be liable to mislead one into banding only those teeth that he would ordinarily band. The making of bands is such an easy and rapid procedure with the modern band-forming pliers that the time necessary for this operation has been eliminated as a deciding factor.

2. The clinics referred to above attempted to cover material presented in Angle, E. H.: Dent. Cosmos, 70:1143 (Dec.) 1928; 71:164 (Feb.), 260 (March) 1929.

Then too, with a square face arch, there is always the danger of decalcification should it rest in direct contact with an enameled surface. The cemented band eliminates this danger. However, the main reason for the banding of teeth is the fact that it is only in this way that we can gain to the limit the efficiency and safety that lies wrapped up in this appliance. Those who adopt this mechanism would be very wise if they started by banding every tooth in the mouth. It is the best way to learn the strong points of the appliance.

Another point to be carefully studied out before starting treatment on any given case is the correct placing of the staples. The position of these apparently insignificant accessories can work either to great advantage for us, or can hold us at a standstill by locking certain tooth movements. These, then, are the fundamental rules behind the appliance. Now let us consider a few actual cases.

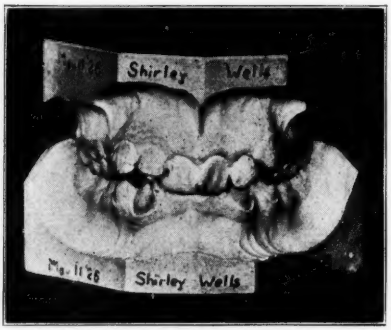

Fig. 25.—Class I developing into Class II Div. 2 case, complicated by a mesial drifting of all buccal teeth, upper and lower.

The case shown in Fig. 7, *A* and *B*, is a typical Class I case of the simpler variety. There was a normal relation of the bicuspids and molars with rotated and "bunched" incisors and cuspids. The slight expansion incident to the rotation of these teeth is all that is necessary for correct treatment. The application of the square arch at the beginning would have been awkward for the lips, so it was preceded by the round 0.022 inch arch. There was no effort made to increase the size of the arch by bringing pressure to bear against the molars, as is the usual practice. The wedging force of the rotating teeth did this for us. While the crowns moved into their places in the arch, there was little or no alining of the roots. To take care of this, the square arch was substituted; and by torque (third degree bends), the teeth were carried into their correct axial positions.

The case shown in Figures 8 and 9 is another Class I case, but it calls for entirely different mechanics. Here, we have a fairly well-developed arch in the lower jaw, although the posterior teeth have all drifted forward after a break at the mesial aspect of the cuspid. Correct treatment in this jaw calls for the setting back of these teeth, rotating of the cuspids and alining of the incisors. In the upper jaw we find a severely contracted arch with the entire right side, from the cuspid region back, in lingual occlusion. Here again, the posteriors have drifted forward so that there is no place for the cuspids to erupt. Our first thought is to get these lingually placed teeth into a buccal position. The mechanics used for this purpose were as follows:

On the left side, mass lingual crown torque was placed in the molar and bicuspid brackets, giving us stationary anchorage on this entire side. On the other side, labial crown torque was placed in the molar and bicuspid brackets. The left side was ligated first, which caused the ideal arch form to assume a position about a quarter inch buccally to the right bicuspids and molars. From this position, the

arch was drawn into these brackets. The incisors were ligated to the arch merely for stability, which was probably unnecessary. Two adjustments of the arch over a period of a month and a half were all that was necessary to move these teeth into their normal buccal position, as shown in Figure 10. Thereafter, the case proceeded in a similar manner to others that will be shown.

In describing the mechanics used on Class II cases, I shall quote from a paper read before the Edward H. Angle Society in July of last year, wherein a comparison is drawn between the ribbon arch and the newest mechanism, as regards Class II treatment.[3] Before doing this, however,

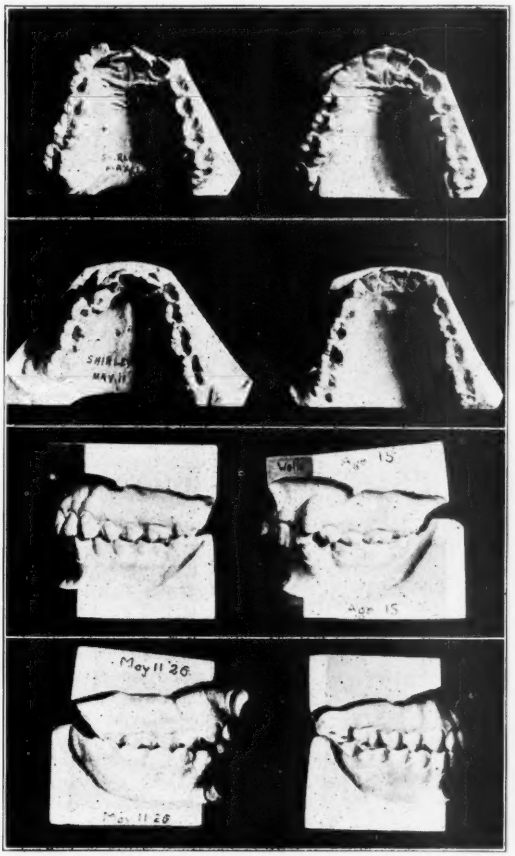

Fig. 26.—Comparative views of the case shown in Figure 25 before treatment and eighteen months after retention.

3. Brodie, A. G.: Rapid Treatment of Class II Division I Cases with the New Angle Mechanism.

I should like to recall to your attention the Angle theory underlying the treatment of Class II cases, i. e., the setting back of the maxillary teeth rather than endeavoring to bring the mandible forward. The ribbon arch procedure is given first:

In the lower jaw we band the first permanent molars and place curved sheaths at such an angle that the arch would lie opposite the gingival border of the lower central incisors. We next place bracket bands on the lower six anteriors and solder cleats to the arch to engage the cuspid brackets. In this jaw, correct treatment calls for an expansion in the bicuspid region, a flattening of the anterior segment of the arch, a straightening up or even a slight distal tipping of the first molars and a depression of the incisors. Coincidental to this treatment this arch must furnish us with stationary anchorage for the distal movement of the maxillary teeth.

As a general rule ligatures are used to expand the region of the bicuspids; the arch in the anterior segment is flattened from time to time and sprung into the brackets to flatten the incisal arc. To tip up the molars, depress the incisors and give stationary anchorage for intermaxillary force, the arch is given lingual crown torque anteriorly and is bent edgewise in a gingival direction just anterior to the sheath nut.

In the upper jaw we band the first molars and place our sheaths so that the arch would lie opposite the gingival of the upper centrals. Bracket bands are placed on the four incisors and occasionally on the cuspids, depending on the operator.

In treating this jaw all thoughts first fly to the first molar and this tooth is driven back by a combination of forces. These consist of first, the screw force, second, the tilting force imparted by the angle of inclination of the molar sheath when the arch is brought down and seated in the anterior brackets, and third, the intermaxillary elastics. The incisors are prevented from fanning labially by the placing of lingual crown torque in these brackets, and they are depressed through their effort to tip up the molars.

When the molars are back to well beyond normal, the bicuspids are retracted by means of the bicuspid loop or by ligatures. The cuspid is taken back in a like manner or by the placing of an intermaxillary rubber connected at its other end to the distal of the mandibular molar sheath. The incisors are taken back by intermaxillary force alone, the sheath-nut being gradually loosened to permit the arch to ride distally through the sheath.

This is necessarily a very sketchy outline of Class II Division I treatment, with the Ribbon Arch, but it will show the various steps that go to make up the plan. In the hands of a well-trained and skillful operator it will show beautiful results, but that this human equation looms very large in its use is shown by the fact that comparatively few men are using it as it was designed to be used.

TREATMENT WITH THE NEWEST ANGLE MECHANISM

First of all we band every tooth in the mouth from the second molars forward, and even these are sometimes banded. Upon the first molar we place the regular molar clamp-band, all others being fitted with either the tie-bracket or alinement-bracket bands. On the buccal surface of the molar band we solder one-half of a tiny rectangular tube, lining it up with the buccal brackets. Ideal arches are applied to both jaws.

Treatment in the lower jaw consists solely of removing this arch from time to time and restoring it to ideal form if it has been in any way distorted. Aside from rotations, for which the arch need not be removed, three or four adjustments are all that are usually necessary to even over-treat the case. When we stop to analyze the mechanics involved, we at once see the reason for this. In the horizontal plane we see the expansive force in the bicuspid region being played against the flattening of the anterior part of the arch, both of which movements we desire. In the vertical plane the anteriors are being depressed through their efforts to tip the molars distally, and as these movements are taking place the bicuspids are being gradually elevated by the vertical bowing of the arch in this region. Stationary anchorage to resist the pull of the intermaxillary elastics is supplied by every bracket that the arch engages. It is much like Ribbon Arch treatment, but it has the advantages of control over the bicuspids; it is more resilient and therefore requires less adjustment; it gives better support to the teeth because the free spans of arch are shorter and anchorage is increased to

far beyond any demands that will be made upon it. Stated simply, every tooth is anchorage and yet every tooth is moving.

In the upper jaw we gain these same advantages, but our problem being different we go at it in a different manner. When our patient returns, following the primary application of the ideal arch and before removing it, we do the following: With a fine explorer we scratch-mark the arch at the anterior end of the molar tube, opposite the centers of the cuspid and bicuspid brackets, at the mid-point between the centrals and at the spots where we wish to place our intermaxillary hooks. The arch is then removed.

We place the little arch bender[4] on the arch so that its distal side coincides with molar scratch-mark and make a slight bend in a gingival direction, *mesial* to the bender. Thus the thickness of the tool separates the bend from the scratch. The operation and its result are shown in Figure 11.

Next, placing the bender so that its mesial side uncovers the second bicuspid scratch-mark by one-thirty-second inch, we make an equal bend in an occlusal direction at the *distal* side of the bender. Figure 12 shows this bend and its result.

Sliding the iron forward until its distal side uncovers the same scratch-mark, by one thirty-second inch, we make an equal bend in a gingival direction at the *mesial* side of the bender. The result is shown in Figure 13.

These last two bends are repeated at both the first bicuspid and cuspid scratch-marks, and when completed give us an arch such as that shown in Figure 14 above. All the bends I have just described are therefore in the vertical plane and are called second degree bends. The hooks for our elastics are now placed and we are ready to insert the arch.

Before proceeding with a consideration of this part of the work, a few words about the measurements and bends that I have just described are in order. First, the bends are made equal only to start the case. At all subsequent adjustments a different procedure is followed, which I shall describe later. As for the reason for the bend of the arch at the distance from the scratch-mark that has been described, there is this to be remembered; these bends must be increased from time to time and every bend shortens the distance between the molar and cuspid scratch-marks. At the same time the distance between tooth centers is unchangeable. Therefore, unless the segments of arch that engage the slots be made long enough, we soon find that one of our bends is in the way of a bracket and a new arch has to be made. On the contrary, if made long enough the arch will be good for the entire treatment and the bends will be always in the correct position, although the brackets will not engage the arch in identically the same spots every time. The length of the segments that is gained by the methods outlined has been found ample for all average cases.

The inserting of the upper arch is done in the following manner: The arch ends are slipped through the molar tubes and the anterior part of the arch is sprung down until it engages the slots of the central brackets, and the midline scratch on the arch coincides with the midpoint between the centrals. You will have noticed that there is nothing on this arch to prevent either end from going too far through its buccal tube. The midline scratch is for the express purpose of preventing this by definitely locating the arch in this plane. The centrals are ligated to the arch and then the laterals. When we now examine the relation of the arch to the cuspid bracket, we find that it lies occlusally to the slot and that when we raise it to opposite this point it crosses the slot in an oblique direction, from below in front to above in back. From this position it is sprung into the bracket with the fingers. It is then ligated. Going next to the first bicuspid we find the same condition that prevailed for the cuspid, except that here the arch does not lie occlusally to the slot. The same method is used in seating and tying it. The second bicuspid presents the same condition and is treated in a like manner. With the slipping on of the elastic our appliance is complete.

Before analyzing what is going on in this arch, let us briefly review for a moment a few facts that we know about tooth movement in general. Let us suppose that we had an isolated second bicuspid present in the mouth, the first bicuspid and first molar having been lost. We fashion a band for this tooth and solder to its buccal surface a horizontal lever in the form of a piece of arch wire, the ends of the lever being equidistant

4. See illustrations of the arch bender in Angle, E. H.: The Latest and Best in Orthodontic Mechanism, Dent. Cosmos, 70:1143 (Dec.), 1928.

from the midpoint of the buccal surface, say one-half inch long on each side. If we now exert force in a gingival direction at the mesial end and in an occlusal direction at the distal end, and if the lever be held in such a manner that it could not move in either a mesial or distal direction, we would expect to see the crown of the tooth go slightly mesially and the root distally. (Fig. 14, below.) This is the principle of stationary anchorage.

If, however, we could so apply our force or power on the lever so that it came from an outside source, so that the ends of the lever were enabled to move in either a mesial or distal direction, we would expect to see a tipping of the tooth in a mesial direction with the apex acting as the center to the arc.[5] If we exerted our forces in an opposite direction the tooth would tip distally. This is the underlying principle of what Dr. Angle has called the Picket-Fence. (Fig. 15.) Let us go back to our case and see how it works.

Figure 16 is a diagrammatic drawing of the arch containing the second degree bends, lying outside the brackets and showing its relation to them. Figure 17 shows the arch after it has been sprung into the brackets. Starting with the molar, we see that the gingival bend anterior to the molar tube is giving us an elevating and backward pry on this tooth, exactly as is the case in Ribbon Arch treatment. Our source of anchorage, however, is the second bicuspid instead of the incisors, and this tooth, like the incisors in the Ribbon Arch treatment, receives a reciprocal depressing force. This depressing force is confined to the distal half of the bracket by the oblique bending of the arch already referred to. The mesial half of the bracket is receiving an elevating force from the first bicuspid, the distal half of whose bracket receives a depressing force as a reaction. The first bicuspid is being acted upon in the same manner, receiving an elevating force from the cuspid and a depressing force from the second bicuspid.

We see from a study of this diagram that the two bicuspids are the prey of equal or balanced forces, but that only an elevating force is acting on the molar and only a depressing force is acting on the cuspid. We desire the molar elevation but not the cuspid depression. This latter tooth must travel back with the other buccal teeth if we are to accomplish our aim, and to do this it needs the mesial elevating force. Our only remaining source of available power lies in the incisors, which need depression. By springing down our arch into these brackets we accomplish both the depression of these teeth and the mesial elevation of the cuspid.

It must be remembered at this point that we pass into a different plane of space when we cross the cuspid eminence and the "picket-fence" does not operate as a principle beyond this point in this type of case. The incisors are to be moved *backward,* not distally, and this is accomplished solely by the elastics. Theoretically we should need a lingual crown torque on these teeth to aid in this movement, but this I have never found necessary. They swing back at the same time that the buccal teeth are going distally and at the same rate of speed.

So in this jaw we see again that no tooth or teeth can be called anchorage in the same sense that we have used this term in the past. Each tooth is not only moving but is assisting every other tooth to move and every desired movement is taking place at the same time.

Treatment in this jaw consists of removing the arch from time to time and reshaping it to its ideal form in the horizontal plane, if it has become at all distorted. This takes care of all rotations, expansions, etc. To continue the distal movement of the maxillary buccal teeth and the depression of the incisors, we gently increase the original bends in the vertical plane. I mentioned before that these bends were made equal only at the beginning of treatment. At all subsequent adjustments the arch should be tested at each bracket to see that force is being exerted on all. A little practice in this will soon teach one that these bends must be increasingly sharp as the front of the mouth is approached; otherwise these teeth do not receive enough stimulation to enable them to keep pace with those in back. We treat until all buccal teeth are slightly distal to normal and the incisors edge to edge. At this point we usually have a distal tipping of the bicuspids and the arch is released from these brackets to enable them to straighten up. This, as you know from your experience with the Ribbon Arch, takes but a short time. While it is taking place the arch is left in its former position with the inter-maxillary rubbers in place. When the bicuspids have

5. Albin: Oppenheim, Tissue Changes Incident to Tooth Movement.

settled down into occlusions we are ready to retain.

The case shown in Figure 18 was treated in the manner just described, over a period of four months. Figure 19 shows comparative occlusal views of the case before and after treatment, and Figure 20 shows the articulated final result immediately after removing the active appliance. The amount of overtreatment is apparent.

Figure 21 shows another case of the same type before treatment, and eighteen months after the retention apparatus was removed. This case, which took six months, was that of a young woman, aged 21.

The case shown in Figure 22 is much like the one in Figure 8, except that here both sides of the maxillary arch are in lingual occlusion. It is a Class I case calling for Class II mechanics in its treatment. If we carefully examine Figure 23, we see that the lower jaw is almost perfect except for a few rotations and a slightly accentuated curve of Spee. In the upper, we find that the incisors are in normal relation to those of the lower, except for one lingually locked lateral. On the buccal segments, we find the molars in lingual occlusion and the bicuspids forward to such an extent that they almost totally occlude the cuspid space.

Correct and logical treatment in this jaw calls for an expansion and for a setting back of these teeth to their normal relations, without any labial displacement of the incisors. We accordingly banded these buccal teeth and applied the ideal arch with both second and third degree bends, i. e., with both buccal crown torque and the "picket fence." Intermaxillary hooks were placed at the cuspid region. Instead of scratch-marking the arch at the middle of the brackets, we marked it at the mesial edge of each and made the anterior bend for each segment at this point. Thus, the entire length of the segments or levers lay within and behind the brackets. We then drew the arch out of the buccal tubes until it stood away from the incisors about one-sixteenth inch and in this position engaged the buccal brackets and ligated. The incisors were not banded or even ligated to the arch at this time. Intermaxillary elastics completed the appliance. Treatment consisted in removing the arch from time to time and increasing the second degree bends and then replacing it so that it again stood away from the incisors one-sixteenth inch. By the time these buccal teeth were back in their correct mesiodistal relation with the lower teeth, they were also in their correct buccolingual relation, and treatment from here on became merely an alining of the incisors. Figure 24 shows the case just after the incisor brackets had been placed for this final operation. It will be noted that the upper central incisors and left lateral incisor have ridden back to an edge-to-edge position. This was caused by an illness on the part of the patient which prevented her coming and having the arch moved out as described. As a result, the arch pressed against these teeth and carried them back with the buccal segments. The time of treatment between Figures 22 and 24 was two months.

The next and last case to be shown was the first ever treated by me with this mechanism. The work was done in the Angle School at Pasadena in a space of nine months, and it tested to the limit the capabilities of this appliance. It was classified as Class I, rapidly going into Class II, Division II, and complicated by a protrusion of both the mandibular and the maxillary arches. The original model is shown in Figure 25. Had it been

treated in the usual manner of expanding until alinement was gained, I am sure the patient would never have forgiven us.

In this case, every tooth, including all molars, was banded and second degree bends were placed in both arches to tip all the buccal teeth in both arches back. The incisors in this case were of great help to us, as they presented not only a backward displacement but also an excessive overbite. We used them until they were forward to their normal position, and until the bite was open in front by one-eighth inch. By this time, the whole upper jaw was pretty well taken care of, and was in somewhere between a Class I and Class III relation with the lower. The lower had not moved so rapidly, and not wishing to disturb the upper by using it as anchorage, we finally resorted to occipital anchorage at night. This the patient wore for two months; and by this time, the lower was back in a Class I relation with the upper. In this position, it was allowed to settle and then retained.

Figure 26 shows comparative views of the case before and after treatment. They were sent to me last June to show the case as it then was, after a year and a half.

1300 Medical Tower.

OPERATIVE DENTISTRY, WITH SPECIAL REFERENCE TO THE MORE DURABLE RESTORATIONS*

By W. D. N. MOORE, D.D.S., Chicago, Ill.

NO higher duty comes within the range of dental service to humanity than that of filling teeth in as nearly permanent a manner as possible. From the very beginning of dentistry as an organized profession, the saving of human teeth was one of its fundamentals, and no other one practice on the part of our profession has been so generally and signally recognized in the accomplishment of a definite purpose as that which has been obtained from the operative department of dentistry. The other departments have been so fraught with elements of uncertainty and such radical changes in methods that more confusion prevails today in the minds of general practitioners concerning methods of practice in those departments than has ever been known to operative dentistry.

In realizing the many changes in other branches of dentistry, one cannot fail to be impressed with the sound fundamental principles upon which the teachings and practice of operative dentistry were based. These principles had been carefully and rationally worked out by those enthusiastic about the use of gold foil for filling teeth, and at a time when operative dentistry was in the vanguard of the profession. Focal infection, removable bridges, centric occlusion and the surgical extraction of teeth were yet unborn. No such intrusions as these disturbed the work of these men who were building well for the future good of dentistry and humanity. They seemed to leave little to exploit as is being done in other fields of den-

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tistry. Papers and clinics in this work played the important rôle on all dental programs. All this left a mighty impress on operative dentistry and resulted in the development of an enviable skill and enthusiasm for this work. In recent years, operative dentistry has not received the attention of the profession that it formerly did. A diversion of interest to new ideas in other departments of dentistry seemed so alluring that operative methods were no longer in the foreground of dental discussions. Operative dentistry became apparently insignificant in comparison with new developments. It was so lost in the maelstrom of new theories and ideas in other branches of dentistry that its radiance was clouded.

In whatever pursuit the human mind and hand are engaged, no greater reward can repay the efforts expanded than durability of service accomplished for the good of others. To the conscientious operator, this has a significance of the highest order, and it maintains within him an enthusiasm that has a stimulating influence on his fellow practitioners also. Services of a durable nature reach beyond the bounds of our own profession. It not only receives a wholesome recognition and appreciation from those that are recipients of such service, but also impresses the mind of the laity generally with the importance of good dental service for human welfare. It makes a profession a reality rather than a mockery. It can truthfully be claimed that no other service in dentistry has done more in this capacity than filling teeth in a permanent manner. Dentistry as a profession owes its very existence to this truth, as it is realized that other lines of practice have made such amazing advancement in recent years.

The attainment of results that are to be regarded as permanent in operative dentistry is dependent, usually, on three definite considerations: 1. Existing conditions of the oral cavity of the patient. 2. The judgment of the operator and his technical skill. 3. Choice of filling materials and their proper manipulation. The operator who has all these at his command is well fitted to render the highest type of service to his patients.

If the mouth conditions of a patient are due to a lack of good general health, or a lack of care or a combination of these, a severe test for durability in our operations is to be expected. In the case of children, much can be accomplished that will be helpful in overcoming unfavorable conditions, particularly from the standpoint of sanitation. Conditions resulting from a condition of general health that is below standard combat our best efforts most persistently. Whether these conditions are local or systemic, a remedy should be sought and applied, if good results from the filling of cavities in the teeth of these patients are to be anticipated. Diet, it is hoped, will do much to improve many of these discouraging cases; and yet, contrary to all the claims made for proper diet, and in spite of all that the sciences of today recommend to check caries, teeth do decay.

It is of more than ordinary interest, however, to observe at times an almost perfect dentition in the mouths of some young patients and to learn that the diet of that patient is one that supplies liberally calcium and other bone and tooth-building elements. But metabolism in all children is not always similar, and what is "meat" for one is "poison" for another. It is well to recommend as nearly as possible diets that are best suited to supply the elements required in tooth and bone composition. If the mouth manifestation is directly due to a lack of general health, the patient should consult

a physician. The most baffling cases that confront us as operators are those which present good hygienic conditions in the mouth and good health generally. Immunity has given way to susceptibility, and the patient offers freely the information that he has "soft teeth" that will not hold fillings. This statement is made with such assurance that it has apparently long been his firm conviction and he is reconciled to it. It is my firm belief that this idea was wrongly given the patient by his dentist, and the fillings that failed were due to poor operations rather than to the presence of the so-termed "soft teeth." It is true that a pronounced susceptibility to decay is frequently found in clean mouths of healthy patients, and these cases more than all others require the persistent and frequent watchfulness of the dentist, together with the greatest skill in the insertion of fillings. It would seem, then, that the ideal for expectancy in operative work would be found where the conditions of the oral cavity are good and the health of the patient faultless. In such environment as this, the skilful operator has the greatest opportunity for rendering service that will be lasting.

When a full knowledge of the prevailing condition of the mouth in which there are teeth requiring filling has been ascertained, a great deal has been accomplished preparatory to making operations that will give satisfactory results. Today, as in the past, dentists have too frequently been inclined to give credit for fillings that have seen long service to the materials alone that had been used. This may or may not be true. It is at best only a part of the procedure that has gained a successful result. The judgment, skill and technic employed are often overlooked, when, in truth, these are in a large measure responsible for the success of the filling. It requires good judgment to know what methods of procedure are best adapted for the different cavities to be filled. The hygienic condition of the mouth and the location of and access to the cavity will help determine the treatment that promises most for durability of results. The condition of the tissues surrounding the teeth to be operated on must be carefully considered and good judgment used before proceeding with the work. From the general appearance of all the teeth, much can be learned of the stress and the strain exerted in that mouth. In brief, good judgment as to the general appearance of the facial development and dentition, particularly if many teeth are missing, will do much to invite success in what is to be undertaken.

Allied closely with good judgment preceding operations is the employment of a skilful technic. Durability in the filling of natural teeth is due more to this one element than any other factor employed in the procedure. Skilful technic should have its beginning with the first stroke of the instrument and should be closely followed with each and every detail of the operation to its conclusion. Beginners should early be impressed with its importance. When acquired, it is a mighty weapon in avoiding failure. It is the very warp and woof of all successful dental operations. In cavity preparation, good technic is fundamental. The lack of it has contributed to more failures in fillings than any other one cause. Given the principles as laid down by G. V. Black and others of his teaching, with the proper application of good technic, and the cavity obtained will be the basis of a filling that will be durable in character. It is interesting to observe the number of fillings inserted by operators known to be familiar with

the correct principles of cavity preparation that show a failure to employ proper technic. Many times, there is a reason for this.

Certain conditions of the teeth forbid correct cavity preparation, and these are excepted. The point is, there is too frequently a lack of balance between the principles of cavity preparation and the execution of these principles. Often, it is the technical detail that has been sacrificed, with deleterious results. Gaining extension without overextending the walls of the cavity; forming these walls to a definite and uniform plane; obtaining uniformity of depth of the cavity, with a consideration for the health of the pulp; securing the correct beveling of all margins; disinfecting dentin and filling in the inequalities of all the surfaces of the cavity with a good cement, and leaving each surface smooth and in perfect continuity are some of the more important requirements for a well prepared cavity that skilful technic can effect.

The materials used in the filling of cavities in teeth, together with the methods employed in their use, have always been a subject of more than ordinary interest. No one material or method will most adequately meet all the requirements for all the conditions that are to be met in daily practice. The best results are to be had from a choice of materials and methods best suited for the case in hand.

The filling materials classed with the group known as plastics have been dealt with by J. D. McMillan, and a discussion of any of these, except for a brief reference, is not within the range of this presentation. I feel, however, that a discussion of filling materials that have rendered durable service in the mouths of patients should necessarily give some consideration to amalgam, undoubtedly the most commonly used of all filling materials. It has a distinct place as a tooth saver and has proved its worth by the long years of service that it has rendered its host. Where economy is an important consideration on the part of the patient, its use in the posterior teeth is clearly indicated; and, when properly inserted, it will render a creditable service. Its use is indicated in those cavities difficult of access for the manipulation required for other materials, particularly gold foil, and in those locations that are not easily cleaned or cannot ordinarily be maintained in a hygienic condition. Here, its therapeutic properties prove to be of considerable value. Its liability to change form and discolor tooth tissue has incurred much unfavorable criticism from both patient and operator.

Amalgam also permits of its own abuse, obviously for the reason that it is as easily inserted in improperly shaped cavities as it is in those of correct formation. It is not so exacting in its demands for good technic as some other materials and it is too tolerant of indifferent methods on the part of the operator, a feature not conducive to the maintenance of high standards or ideals in dental practice.

Of all the filling materials used in operative dentistry, no restorations have proved more durable than those made of gold foil properly inserted in a well-formed cavity. No other one practice did so much in the early days of dentistry to establish the status of our profession as the practice of filling teeth with gold foil. It was enthusiastically employed by the stalwarts and leaders of the profession throughout the country. To be a master in its use was the acme of dental accomplishment and the ambition of the conscientious beginner. Its use marked the dividing line between the artisan and the

professional man. Enthusiasm for it as a tooth saver and the interest developed in its manipulation attracted a galaxy of operators, teachers and writers that have long been revered. They were the sturdy pioneers of dentistry and laid securely the foundation for which every member of our profession owes a debt of gratitude and a deep respect. These men formed the very bone and sinew of what was then a young profession and their names will remain in history glorious to the calling they so well served. This method of filling teeth was so fundamentally sound that their faith in its use in practice has remained unshaken. It will do today just what it was claimed that it would do half a century ago. It has been limited and modified, but its efficiency in the saving of natural teeth stands just as it did at that time.

The practice of filling teeth with gold foil has had a far-reaching effect on the practice of dentistry. Its demands on the operator are such that, when these are fulfilled, a development in training is effected that is especially beneficial to students and beginners in practice. Its continued practice, when skilfully carried out, maintains a standard in mind and skill of hand that no other practice is able to accomplish. It fills the operator with a pride and a satisfaction in a service beyond reproach, and even the layman has long respected its use. Gold foil has long held supremacy among filling materials as a preserver of tooth tissue, where properly inserted in a tooth cavity.

It must be remembered, however, that the success of gold foil is due not alone to the material but also to the good technic that necessarily must accompany the whole procedure from cavity preparation to the final polishing of the filling. Without observation of this essential in detail, gold foil would fall far short of its greatest possibilities, and it is the realization of the importance of careful technic that holds the operator to a standard that has a wholesome effect on his daily practice. It is usually observed that those who are successful in the use of gold foil apply the same principles and care to the other operations that they perform; all of which is highly effective in rounding out a skilful dentist. The exactions of this method, while interesting to many enthusiastic operators, together with the time consumed in their accomplishment, were thought by many practitioners to be too great a toll of endurance on the part of the patient and the operator. Now, the periodontist warns us of the injury to the pericemental tissue from trauma, and places condensation of large gold foil fillings in this category. These are probably the most serious charges laid against this method of filling teeth. In cases of extensive restoration, and particularly if the speed of the operator is not well developed and care in condensation is not exercised, some element of justification might be given to these claims. While most minds are free to acknowledge the tax on the physical endurance demanded by large gold restorations, significance must be given the fact that many large restorations have served their host most satisfactorily for upwards of thirty years, an outstanding evidence of satisfactory durability.

The use of gold foil has a general application to all teeth where there is reasonable accessibility to the cavity to be filled and where the extent of the restoration to be made is not beyond the endurance of the patient. It is ideal in the one-surface occlusal cavities in biscuspids and molars, particularly the small pit and fissure cavities making their initial appearance in the occlusal surfaces of these

teeth in the mouths of young patients. This is also true of the small cavities on the buccal and lingual surfaces of the same teeth. The smaller two-surface cavities of these teeth can be, with good judgment and practice, durably restored by the use of gold foil. Its use in any of the six anterior teeth and in the smaller proximal cavities has never been questioned on the point of durability, when properly inserted. In these teeth and under favorable conditions, it is as much indicated as it ever has been, provided there is no protest as to its color on the part of the patient. Although the durability of gold foil may be accepted, there is today a pronounced aversion to the display of several gold fillings in the anterior part of the mouth by many patients, and there is a good reason for it, particularly if these fillings are of the size that will make gold conspicuous. In certain individuals, this disfigurement is intolerant and out of harmony with other artistic features. In these teeth, the indications or contraindications for gold foil are best evaluated by a good operator. Consideration of the artistic condition in which the teeth are found, the number of gold fillings or cavities or both already present, together with the general artistic features of the individual, will help materially to determine whether or not a gold filling should be placed in the front of that mouth. Ability to make this distinction is the basis upon which a decision should be made.

This question may then arise: Should the esthetic qualities of a restoration in the anterior teeth supersede the characteristics of durability? The ideal would seem to be a combination of these. Durability is a quality always to be desired and, where possible, obtained, and should only be qualified when the conditions definitely warrant a less stable method. Difference of opinion with regard to the most suitable filling materials for general use is likely to long prevail. Personal equation and aptitude will always have their bearing on this question. The necessity for durability of contact point, and hence the proper maintenance of the interproximal space, is too great to trust to a filling material unstable in character. Failures have been too common to warrant their continued use in proximal cavities of the anterior teeth or of any other teeth.

The old idea that the cavities in permanent teeth of young patients should not be filled with gold foil was a fallacy productive of no good and of much harm. It was destructive to the teeth themselves and their surrounding tissues, and to the dental education of the patient. Temporizing with the smaller cavities in any of the permanent teeth of young patients is rarely justified for other than economic reasons. The filling of these cavities in a durable manner precludes subsequent operations for refilling and a possible correction of position of the teeth in that location. With the knowledge we have today of the possibilities of pulp infection through the dentin, this would seem sufficient to require practitioners to aim to fill these small cavities with gold foil at first in a manner that would promise the greatest durability. This would not only be rendering ideal service, but a favorable impression would be made on the patient, which temporizing fails to accomplish.

When special reference is made to durability of filling materials, gold foil in combination with tin foil should receive favorable mention. The use of this combination of foils in large restorations in molars in the gingival third of two surface cavities assures speed of insertion of the filling as well as affording the

therapeutic effect of tin. It has been no ordinary satisfaction to examine these large restorations after long years of service and note their durability. The same can be said of the combination of gold and platinum where it is indicated. While the general practice of these methods has been replaced by other methods in recent years, their service in the past has borne testimony to their lasting qualities. It can hardly be predicted that gold foil will ever be so much employed in the future as in the past, yet when properly inserted in a cavity it can be truthfully said to have no superior for preservation of tooth tissue.

Many conditions had to be considered before it could be definitely stated what size restorations should be attempted with gold foil. The speed of the operator, the attitude of the patient and the condition of the tooth requiring attention are all important factors in determining its use. It must be generally conceded, however, that while gold foil is a most durable filling material for one-surface and the smaller two-surface fillings, its demands on the patient, the operator and the tooth operated on for larger restorations are sometimes more than the endurance of any of these can well tolerate. In very extensive cavities, where the remaining walls of the tooth have been weakened by decay, or for other reasons, and require the support of, instead of giving support to, the filling material, gold foil has reached its limitations and must give way to other means of restoration better suited for these cases. The cast gold inlay has provided the means by which these can be durably made with a tolerant strain on patient and operator. When William H. Taggart gave his process to dentistry, it was one of the greatest achievements ever made in our profession. It has met a requirement beyond the possibilities of any other filling material for the durable restoration of extensive loss of tooth tissue in an ideal manner and has saved many a tooth from wearing an artificial crown.

The principle of inlaying teeth is logically and mechanically sound. The application of good judgment and skilful technic plays the same rôle of importance for success as in any other operation. The charge of overstrain on patient and operator that has long been laid against large gold foil fillings can be dismissed by the use of the inlay in its stead. It does relieve the patient of the long and wearisome effort necessary for the insertion of gold foil, and the tooth to be restored is spared the continued strain during the condensation of this material. Previous to the general use of the inlay, the restoration of extensive cavities in posterior teeth possessing walls of comparatively little remaining strength, with any assurance of durability, was practically impossible. This is particularly true when but one or two walls of a cavity remain. The walls of cavities of this type can best be supported and protected from stress by the use of the gold inlay and in a manner no other means has yet provided for with the same degree of strength. Its use permits of correct anatomic form and a definite and accurate restoration of occlusal surfaces for these large fillings that is so important for efficiency, and that it is so difficult to obtain by any other means of filling. When restorations included large occlusal areas in bicuspids and molars, and there was a marked wearing stress exerted on all teeth, filling materials of sufficient hardness to resist wear were not to be had previous to the use of the gold inlay. Platinum in combination with gold had been used in small

restorations in an effort to gain these qualities in a filling.

The wearing quality of a filling material in the cases referred to is very important for the welfare of the whole masticatory apparatus, especially in those mouths in which there are a great many large fillings in posterior teeth and extreme wear is evident. In such cases, it is imperative that a hard metal be used. The inlay method has provided for this important consideration. The lack of proper form of cusp and a gold of insufficient resistance to stress are often responsible for inefficiency in mastication in that part of the mouth. It frequently is the answer to the statement made by the patient, "I do not use that side of my mouth"; which at first glance is in good condition. The gold inlay properly made provides the means to remedy such conditions. Probably, no one of all the details that are required for a gold filling is more important than the contact point. Without proper form and density of the contact point, a filling is more or less a failure. Location and size can be made as desired. By the removal of a small area of wax where the contact point should be and after it is cast, this depression in the gold can be restored with 22-carat gold solder. This will provide a surface most resistant and durable to the abrasion of the neighboring tooth at this point.

These are advantages in details which the use of the gold inlay affords, and they are conducive to a durability and efficiency which other methods in operative dentistry do not provide. While reference is being made to the necessity for the use of a gold suitable to the case, a brief consideration of this might be made at this time. One of the cardinal and highly respected features of the gold foil filling is the fact that the material is pure gold and possesses the superior quality that should be, whenever possible, associated with human tooth tissue. It affords a mental satisfaction that should always play an important part with the operator and patient. The use of materials of a high quality is closely linked with skilful technic and it stimulates to better service. A departure from this standard in the use of metals has not the best effect on dental operations. If 24-carat gold is not of sufficient resistance or hardness, it can usually be made so by the addition of 2 to 3 per cent platinum, a metal of equal nobility. Except in cases making unusual demands, this combination will prove sufficient for the average restoration. The practice of using gold of low carat or unknown composition for filling teeth should always be discouraged.

While it is true that much can be claimed for the usefulness and the durability of the cast gold inlay when properly made, it is not void of criticism. Its most vulnerable point is its sealing medium—cement, an unstable compound. This can be controlled to a great extent and kept within the bounds of safety for durable service by the application of skilful technic and observance of all the minute detail and principles pertaining to its construction. It is well known that the solubility of cement is greatest when its greatest area is exposed to the fluids of the mouth and least soluble when least exposed. Hence, the better the adaptation of the metal to tooth tissue, the more dependable becomes the cement; an important truth to remember in inlay work.

Proper adaptation, then, is one of the most vital results to be accomplished in making good inlays. It starts with correct cavity preparation. The very fact that wax can be adapted to a poorly made

cavity has been responsible for much unfavorable criticism of the gold inlay. This has been one of the main reasons for its abuse and misuse. All the walls of the cavity should be definitely formed and made smooth and free from irregularities if the best results are to be expected. Correct cavity preparation for a gold inlay is the most important step in the making of a well fitting inlay. It is only rational to expect that almost any adaptable material can more readily, and with better results, be adapted to smooth and uniform surfaces than to surfaces indefinitely and irregularly formed. If the gold inlay made the demands for good cavity preparation that the successful use of gold foil did, fewer failures in its use would result. Cavity preparation for a gold inlay does not generally tax the skill of the operator to the extent that cavity preparation for gold foil does, though it should. This too often leads to an indifference that does not result in the best standards of operative work. This is more or less true of any of the easier methods of practice in dentistry. They too frequently invite a negligence that is not conducive to the highest ideals. Human nature is prone to overindulge. This is not confined to the technic as it applies to the inlay itself, but to the use of the gold inlay to the exclusion of other means of filling teeth, particularly gold foil. The gold inlay seemed to gain such a hold in operative practice that foil instruments no longer had a place in dental equipment. This is partly due to overenthusiasm for the inlay method and to the opportunity for transferring a large portion of the work to the laboratory and other hands. Proper discrimination in the selection of methods and materials is necessary for success and durability in filling teeth.

Gold foil is distinctly indicated for use, as previously stated, in the smaller cavities in teeth. The exclusive use of the inlay has invited a just criticism even though there may be certain small cavities that would indicate its use. An illustration of these exceptions might be gingival cavities on bicuspids and molars that are well under the free margin of the gum, and where clamps and the necessary polishing of foil fillings might unduly injure the soft tissue. In certain small fillings exposed to excessive stress, and in which a harder material than pure gold is required, the small inlay would be indicated. Along with the criticism attending the too common use of the small inlay has gone criticism of the use of the large inlay for its frequent irritating effect on pulp tissues. If a cavity is not large from extensive decay, it is wrong to make it so to facilitate the insertion of an inlay. This practice cannot be too vigorously condemned. The responsibility for this should be charged to a lack of judgment in the selection of methods rather than to the use of the inlay. Extensive inlay restorations in vital teeth should receive careful consideration from the operator. Cavities should not be made deep, and wherever they are, from whatever cause, a cement base of sufficient thickness should be placed in their deepest parts and its surfaces made smooth before adapting the wax.

Close proximity of gold to pulp tissue must always be avoided. Pulp involvement in large cavities may be, and no doubt is, as much due to previous infection of the dentin as to the presence of a large gold inlay. Irritability of pulps is frequently due to forcing tight inlays into cavities against unprotected dentin. It would seem only reasonable that phosphoric acid might be forced well within the dentin and produce irritation to the pulp if not more serious results. This is usually manifested by extreme sensibility

to thermal shock. Even if the cavity is not deep and no cement is required, a good cavity lining preparation is valuable. This is particularly indicated in teeth of young patients. These precautions are to be recommended not only for extensive cavities but for the smaller ones also. When it is realized what extreme pressure can be exerted on cement in setting these tight-fitting inlays, it is not surprising that soreness of the teeth results, especially in the tooth of the young patient where the pulp chamber is still its full size.

From this, it is not to be inferred that the inlay is not indicated for cavities in the teeth of young patients. It is, but it must be used with extra precautions. These cases can be ideally cared for by means of the inlay method for the reason that less strain is involved on patients at this age than would be for gold foil operations. For over twenty years, the cast gold inlay has been extensively used as a means of filling teeth, with the result that experience in its use is not unlike that associated with any other method which has preceded it. Its success and length of service will depend on good judgment and the skill employed in its technic.

To satisfy the esthetic requirements that frequently have to be met, particularly for fillings in any of the six anterior teeth, the porcelain inlay must receive some consideration. It requires a great deal of courage today to make even a moderate plea for its use. Its characteristics are so refractory in their nature that these are not always easily controlled, and when they are not, disappointment results. In addition to this, the lack of good judgment in its use has been accountable for many of its failures.

On the contrary, with the operator who is familiar with all that porcelain demands and is able to satisfy these, and who by his natural artistic inclinations for the esthetic is able to simulate natural tooth color in porcelain, the porcelain inlay is capable of rendering a service that is not only durable but also free from the disfigurement that so frequently accompanies gold restorations. It is most indicated in those cavities that are distinctly within the range of ordinary vision and where the use of gold would be displeasing. This would usually include gingival and labial cavities of the six anterior teeth and, in some instances, the first and second bicuspids. In large simple proximal cavities of anterior teeth and sometimes the first bicuspids that have a decided extension toward the buccal surface, a well-made porcelain inlay will give admirable service. If these cavities involve the incisal surface of any of these teeth, preference for its use must be governed entirely by good judgment and the kind of strain that it may have to endure. In cavities of the mesio-incisodistal type in central incisors where good judgment would ordinarily have contraindicated the use of the porcelain inlay, and it is inserted entirely at the request of the patient, its use has given many years of satisfactory service, to the surprise of the operator. While this is not here advocated except in the most favorable cases, it is a challenge to many unfavorable comments concerning its use. The porcelain inlay is an imitation, and imitations rarely receive the whole-hearted regard which they may merit, yet the partial restoration of a natural tooth in a manner that is free of detection to ordinary vision is an art worthy of encouragement and further development in operative dentistry.

It is to be regretted that operative dentistry has in recent years been allowed to slump into the background of dental

affairs. A revival of interest in this subject is sorely needed if we are to be consistent in our claims to be practicing preventive dentistry, so much advocated in the present day. We boast of what is being done in public service work in spreading the gospel of prevention, and yet the very pith of the whole situation —operative dentistry—is apparently a very dry subject, and has been for some time. Preparedness to meet the onslaught of dental caries in an effective manner is no mean duty to perform, and interest in those things that pertain to the advancement of this work should be of vital importance to every conscientious dentist. It is unquestionably the dentist's first duty to acquire knowledge and skill in the art of filling human teeth and to maintain throughout his active service an interest in the highest standards in its practice. No finer types of professional men ever graced the profession of dentistry than those who in years gone by were the leaders in operative dentistry, and a plea is here made to revive their spirit and emulate their lives in dental practice.

No matter how much we advance in our theories and practice of prevention, no matter how much we learn about diet and its effect on mouth conditions, the time is far off, if indeed it ever comes, when the chief reliance for the saving of the natural teeth will not fall on the skilful practice of operative dentistry.

FILLING MATERIALS AND THEIR INDICATION IN THE PRESERVATION OF CHILDREN'S TEETH*

By CORVIN F. STINE, D.D.S., Evanston, Ill.

THE paramount reason for the filling of teeth is to restore and maintain normal health conditions and esthetic features. The filling of deciduous teeth has been a much neglected subject, but the daily increasing knowledge of their important rôle in the physical development of the child is demanding a more earnest and sincere attempt at intelligently coping with the situation. The relative importance of maintaining the deciduous teeth in their arches is just beginning to be recognized by the profession at large. For some time, the extraction of deciduous teeth with large cavities and the flowing of cement into the smaller cavities, together with the occasional brushing of the anterior teeth, constituted complete dental service for the child. But time has dealt more kindly with the situation, until now more care and study are given these problems.

The problem of correct dental service for the adult is relatively more simple, even with its many complications, than the intelligent and constructive problems that must be faced in caring for the teeth of children. This type of service demands an intimate knowledge of childhood and its many problems. The problems of infancy differ from those of childhood and they, in turn, differ or change in the stage of adolescence. The

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strains and traits of heredity have to be distinguished from the acquired habits of environment. Not only the mere filling of a cavity, but also the questions of diet and diseases, with their kindred alliances, present problems of a baffling nature. The zeal of each one to assist nature in producing permanent teeth of complete and perfect development plunges us headlong into the theories of calcium fixation; which usually leaves us groping about in a realm of uncertainty as to the procedure for grasping the ideal.

For the future, there are the remains of the past to guide us. The results of neglect of the past should be a warning as to the necessity of constant care from the earliest incipiency. Ignorance as to the importance of early dental care, together with the indifference of both the profession and the laity, has left its unfortunate manifestations. For this to be prevented hereafter will require complete education of all concerned; a task well worthy of, and which demands for its fulfilment, considerable thought and study, together with a tremendous amount of energy.

Operative service for the child, unless of an emergency nature, should not be attempted until the confidence of the child is partially won. Then, by careful study and consideration of the plan of procedure, the utmost trust and confidence can be built up in the mind of the child, that the more difficult and intricate problems may be met more readily and intelligently. The introduction of the dental engine might be successfully presented to the child first through the medium of a small rubber polishing cup. By careful explanation, consent for its use is most easily attained. Vibration will then be minimized, and any infringement on the gum will cause but the slightest discomfort.

The selection of the first cavity for preparation should usually be confined to one of a simple nature, located, if possible, in the deciduous incisor teeth. The ease of access and the diminished sensitiveness, due to early eruption as well as to early root absorption, makes this area the location of our selection for the initiative. From thence, the procedure can be extended to the problems of a more trying nature.

In cavity preparation of deciduous teeth, the old staid and iron clad principles employed in cavity preparation of permanent teeth are just as important and necessary. Extension for the prevention of decay and extension for the retention of the filling are of the same vital importance in the deciduous teeth. More failures have resulted, perhaps, from neglect and oversight of these laws and, in turn, have been attributed to the changing conditions of childhood than to any one other fact. Again, if more time and study were given to the infinite detail of cavity preparation and less time to experimentation on every germicidal or bacteria inhibiting filling material, the ultimate success of worth while service would be greatly enhanced. Far too many men are basing their hopes of success on the advertised properties of certain ingredients of the many filling materials for deciduous teeth found on the market today.

No special equipment is necessary for cavity preparation in children's teeth, but all that can be utilized in care of the adult will prove useful and satisfactory in treatment of the child. All instruments must be kept infinitely sharp. To reduce to a minimum all shock and vibration, all instruments as well as burs should be relatively smaller than would be used on a comparative cavity in an adult. Fear, many times, can be replaced

by a state of confidence with the proper application of a smaller scale equipment. Small stones often can be found useful and are employed with success.

The removal of all decay is imperative, and the thorough sterilization of all dentin is just as important. In my experience, the procedure of permitting a small amount of decay to remain, attempting to sterilize by any means whatsoever and covering with cement or a filling with germicidal qualities, has proved a failure in each endeavor. It has proved a better policy to remove all decay, even at the sacrifice of pulp exposure and its subsequent removal, than to seal in hermetically infection over the pulp. Not to be misunderstood, there is a difference between decay and hard, stained or discolored dentin. In many cases in which hard, discolored dentin could not be removed with sharp spoon excavators, sterilization and subsequent filling of the cavity have proved satisfactory.

In deep-seated cavities, after all decay has been removed, an anodyne treatment of eugenol should be sealed in for a period of forty-eight hours. At the following sitting, the cavity is again sterilized, preferably with phenol (95%) and alcohol or a 1:1,000 solution of acriflavine. Then a thin layer of a paste consisting of thymolized calcium phosphate and eugenol is placed over the area in closest proximity to the pulp chamber and covered with a bland zinc cement. The cavity preparation may then be made pursuant to the insertion of the filling.

Before attempting to insert a filling in which the proximal surfaces of the teeth are involved, it is well to study the conditions existing. If due to caries of long standing and the teeth have moved nearer together mesiodistally, it is well to gain separation and pack with baseplate guttapercha. At the next sitting, a restoration can be made, insuring a normal contact and a normal, healthy interproximal space. Also, to advantage, the tissue in the interproximal space has been forced gingivally, which will permit access for making a better union of tooth and filling at this point. The application of a matrix properly used will prevent the foreign filling material from infringing on the surrounding tissues. A properly restored contact point will prevent the impaction of food between the teeth. These are two factors in the production of gingival lesions and their sequelae.

Most plastic restorations in the deciduous teeth are inserted without regard or thought of occlusal contour and carving. The merit of a filling with proper occlusal contour is greatly enhanced. The fact that a tooth is expected to be lost in a few years is no alibi for a flat, lifeless appearing restoration. There is no period of life that is more important from the standpoint of efficiency in mastication than the decade from 3 years to 13 years. There is no period when a tooth needs its own endowments more, whether natural or restored, for the thorough mastication of food. Incorrect contour may lead to faulty habits of mastication, tend to produce unclean regions in the mouth and cause areas once immune to become susceptible. Faulty occlusal contour may cause incorrect registration of the mandible and do permanent injury to the child. The proper interdigitation of the cusps of the deciduous teeth is just as important as that of the permanent set. Nature usually endows us with deciduous teeth normally and properly interdigitated; why not strive to keep them so?

The proper selection of the correct filling material for cavities of the deciduous teeth is not so simple at many times as it first appears. The specific

existing mouth conditions; the large pulp chambers of deciduous teeth with thin walls of dentin in proportion to the thickness of the enamel; tooth development; root absorption; physiologic and pathologic exfoliation of deciduous teeth; absence of teeth, and the general physical condition are all factors in the selection of filling materials for the cavities in the teeth of children. There can be no set rule, as each cavity presents a problem of its own and must be treated as an individual case as well as a unit of a great masticating mechanism. The remarks, then, must necessarily be of a general nature.

The deciduous teeth will be considered first. The incisor teeth may be filled with a bland zinc cement, which is the least irritating of the cements. Should the cavity be deep seated, a lining of resin and chloroform should first be used. This type of filling needs constant care and frequent replacement. Silicate fillings may be inserted, provided the tubuli of the dentin are sealed with a cavity lining and a layer of zinc cement precedes the filling. In cases in which the incisal angle is involved, the decay is removed and the dentin sterilized and covered with a zinc cement. With a revolving disk, the proximal surface is flattened and made self-cleansing by a mesiodistal space at the incisal greater than at the gingival; a triangle with the apex at the gingival. This procedure is used only in extreme cases. If the incisal angle is not involved, the stress of mastication plays no part and the cavity extends near the pulpal tissue, baseplate guttapercha may be successfully utilized.

In the deciduous cuspid teeth, zinc and silicate cements are used with the proper precautions. In cuspids with both proximal surfaces carious and the incisal angles involved and when it is necessary to have retention for a period of a year or more, the decay is removed and the dentin sterilized and filled with a zinc cement. A gold or platinum crown then protects the tooth for the necessary time of retention. A distoproximal cavity that remains obscure can most successfully be filled with amalgam.

In deciduous molars, small pits and fissures are filled with silver amalgam. Proximoclusal cavities are filled with silver amalgam or gold inlays. The restoring of the distal surface of the second deciduous molar is always an indication for a gold inlay. Thus, the mesial surface of the first permanent molar may be amply protected. In pulpless deciduous molars, beautiful contour fillings in silver amalgam may be made, which, should time deal unkindly with them, may be covered with a gold or platinum crown. Where a large amount of tooth structure is missing and it is necessary only to carry the tooth over a comparatively short time, copper cement may be used. If a filling of germicidal properties is desired over a period of time, a base of copper amalgam may precede the silver amalgam.

In the treatment of dental caries of the permanent teeth, it is well to practice conservative extension of cavities. Many times, before the child becomes grown, it is necessary to replace fillings numerous times, and each replacement demands more extensive measures. When it is necessary to remove fissures, we should mutilate and destroy no more tooth structure than is in good keeping with sane principles.

Cavities in permanent anterior teeth should have all caries removed and dentin sterilized and filled with zinc cement. The outer surface may then be removed and a veneer of silicate cement may be

added to protect the tooth until the child reaches the twelfth to the fourteenth year, when a filling of more permanent nature, such as gold foil, may replace it.

Should the pits and the fissures of the first permanent molar be deep and the union of the enamel rods faulty at this point, we should clean well and sterilize with a 1:1,000 solution of acriflavine. Either zinc or "kryptex" cement is flowed into the fissures. This procedure, for best results, must be so arranged that only the necessary amount of cement is carried to the fissures, that the glaze and glossy, dense finish of the cement may remain to help overcome the acids of the mouth. In occlusal cavities, gold inlays or amalgam preceded by a zinc cement base are best. In proximal cavities, conservative extension is employed and a gold inlay well protected is the filling of choice. Sometimes when a small cavity appears on the proximal surface below the contact point, with complete access made possible by the loss of the deciduous molar, a small metallic filling, well polished, will give admirable service. Atrophied first permanent molars may usually be restored with large gold inlays.

Gold foil has a very limited use in children's teeth. It is seldom used in deciduous teeth and should be limited to permanent teeth that have been in position five or six years. It will then prove most ideal for filling small pit and fissure cavities. It makes a most nearly permanent replacement for the proximal cavities of the anterior teeth.

Gold inlays are ideal in restoring proximal surfaces of deciduous teeth and protecting the mesial surface of the first permanent molar. It is the restoration for the permanent teeth, provided the necessary precautions are taken to protect the pulp. Gold inlays are useful in restoring atrophied first permanent molars to normal function.

Gold or platinum crowns have proved practical on deciduous cuspids and pulpless deciduous molars where great loss of tooth structure has taken place.

Silver amalgam has proved the most satisfactory of all materials for the deciduous teeth. It is quick setting and has great edge strength. It will also resist well the acid conditions of the mouth. The greatest asset of silver amalgam is its ability to reproduce a normal contact and subsequent protection of the interproximal space. It requires more retention and pulp protection because of the ease of transmission of thermal changes.

Copper amalgam is too readily affected by the fluids of the mouth, and it is most difficult to prevent it from infringing on gingival tissues, owing to its slow setting qualities. It is less irritating to the pulp than the silver amalgam, and because of its germicidal properties, it is often used as a base for the silver amalgam. Its staining qualities do not add to its usefulness.

Copper cement has been abused more than any other filling material used in children's dentistry. Miracles have been expected from it because of its germicidal power. Many failures have been noted because of the lack of any definite cavity preparation for its use. Most copper cements stain the tooth structure and leave a dark trail, which is many times objectionable. It is very irritating to the pulp and can not safely be placed in too close a proximity. Its chief use is to tide teeth over short periods of time when considerable tooth structure is missing and a germicidal filling is wanted.

Silicate cements are the most permanent of the cements and also the most dangerous because of the acid content of

the liquid. With a carefully inserted protective layer of zinc cement, it is proving a most valuable material.

Guttapercha, the least irritating of all materials, can be used in a few selected proximal cavities in the deciduous anterior teeth. It is now practically in disuse.

As before stated, every cavity has its accompanying problems, and no two are the same. The filling material that proves successful in one case may result in failure in the other. Only a careful consideration and study of all the problems involved will make possible the intelligent mastering of the condition.

636 Church Street.

A STUDY OF THE MOUTHS OF IDENTICAL TWINS; STUDIES OF THE ANESTHETIC PROPERTIES OF SEVERAL PROCAIN SOLUTIONS; CERTAIN STUDIES OF TISSUE CHANGES IN THE PERIDENTAL MEMBRANE*

By EDWARD H. HATTON, B.L., M.D., Chicago, Ill.

THE subjects herewith presented concern the practical integration of teaching and research. Four phases or factors of the relationships involved are dealt with in this presentation, and this may be classified roughly for descriptive purposes by dividing the persons engaged into the following groups: undergraduate students, graduate students, members of the teaching staff and research workers in other institutions.

Two of these subjects have to do with the work of graduate students. In our school, a clear-cut distinction is made between graduate and postgraduate students. A graduate student is a candidate for an advanced degree and as such must not only complete a definite course of study but must also carry to completion an original piece of work involving the collection of experimental data and the interpretation of their significance as related to what has been done previously by others. Postgraduate students, as far as this discussion is concerned, may be grouped with undergraduates.

The first of these two problems is very simple in its relationship to the subject under discussion. It has to do with what happens to the tooth socket of a dog after the extraction of teeth by both the forceps and the open-view methods. Strangely enough, the review of the literature on this method of experimentation disclosed less than half a dozen pieces of work that had been done and only one that was of material significance, and even this was limited largely to healing after the forceps method of extraction. The results obtained by the experiments performed by Warren R. Schram may be presented in a single diagram of the stages of the healing of the socket up to seven weeks. This diagram was pre-

*Read before the Research Session at the Sixth Annual Meeting of the American Association of Dental Schools, Chicago, Ill., March 26, 1929.

pared from the various histologic sections obtained from the jaw specimens using the camera lucida to impose the outlines of the various sections one over the other and is quite clear without further explanation. The material obtained in this way has been made use of in the following ways: 1. The preparation of a master thesis. 2. The foundation for papers and discussions presented by Schram to the graduate and postgraduate seminar, to the local research society, to the research section of the A. D. A. and to the Midwinter Clinic of the Chicago Dental Society. 3. Enrichment of our teaching collection of microscopic slides for undergraduate use and additions to our lantern slide library.

The second problem concerns the dental arches of identical twins. This piece of work, carried on by Samuel Goldberg, early became complicated because of the biologic relationships involved. The facilities of a dental school to handle such a problem successfully were obviously inadequate and the work was carried on to what seems a particularly happy end because of the generous cooperation of Prof. H. H. Newman of the University of Chicago, an authority on the subject of twins. It seems that this cooperation was mutually helpful because of services rendered to both groups by pooling the information derived from both methods of study.

Some of the interesting conclusions arrived at as the result of this piece work are these: 1. The form of the dental arch and the arrangement of the teeth are inherited and this intrinsic growth force is of more significance than the intrinsic forces of environment such as are brought into play by bad habits and other defects. 2. Right handedness and left handedness are inherited tendencies, and where opposite handedness occurs in twins, various degrees of mirror imaging will be found in the dental arches of such twins; that is, various degrees of greater resemblance between the right arch of one twin and the left of the other than between the corresponding sides. 3. The side preferred for chewing is an inherited tendency and bears a definite relationship to right or left handedness. 4. Where dental decay is formed by defects in tooth formation as deep pits and fissures, decay is found in the same positions in the teeth of twins; and to this extent, dental decay is an inherited tendency. The implications of such conclusions are interesting and far-reaching. Goldberg has presented his subject to practically the same groups as Schram and in addition to groups interested in the biologic aspects of his study.

It must be evident that the training and experience gained by Schram in the first study have helped him in no small way toward a successful career as a clinician in the field of minor oral surgery. It is also equally clear to us that the end results of his investigations have opened up new problems just as significant and vital as his in this same field. Quite a similar conclusion may be drawn as to the effect of the investigation on identical twins on the one who did the work. His whole outlook on the significance of the practice of dentistry has been broadened and enriched, and in whatever branch of dentistry he elects to serve, he cannot but be benefited.

The third problem presented herewith is being carried on by a member of our faculty, assisted by one of our undergraduate students who has a bachelor's degree. This has to do with the toxicity and efficiency of local anesthetics. The particular contribution of the undergraduate students has to do with surface tension determinations. Further than

this, he acts as assistant in the animal experiments. One other type of cooperation is illustrated in this research, and that is the benefit of criticism, advice and suggestion from the department of pharmacology in our medical school.

The work already accomplished by this group has to do with relative efficiency and toxicity of cocain, procain and boricain, using gold fish to determine the various factors. Preliminary reports have already been made by members of the group, H. C. Dailey and H. C. Benedict. They have observed in the case of gold fish that the time element in anesthesia is greatly in favor of boricain, that the toxicity, as might be expected, is greatest with cocain and that the effectiveness has something to do with the surface tension of various solutions used.

It has not seemed proper to use the time of this group in a discussion of the technical details or the subject matter of these investigations, but rather to use them as illustrations of the place of and the part played by research in a dental teaching institution. I have already, in a brief paper, suggested another way in which the undergraduate student might become interested in research by the collection of various types of specimens with suitable histories and data in conducting group studies of various conditions.

It has been suggested that the price paid for the conduct of research in the manner herewith suggested is out of proportion to the results achieved. From the standpoint of the amount and character of research done, there is probably some merit in this criticism. I have felt, for example, that my own output has been distinctly reduced because of the part that I have played in helping to direct the activities of different individuals concerned. On the other hand, the by-products and even the direct results of such methods are immeasurable and, I am sure, worth the effort entailed. It is quite evident to me that had I undertaken the twin study single handed, the results both as to the number of cases examined and the thoroughness with which the data were collected could not have been matched. In the first example discussed, the operations on the dogs were very well carried out. I could not have done better or even so well. Although the work of the preparation of the histologic specimens required considerable oversight, even in this phase of the work we covered much more ground than I could have covered unassisted except by technicians. Apparently such a method of procedure will increase the total amount of work done in the institution to a marked degree. Wherever possible, the work is published under the name of the student doing the work, and he is given the usual author's rights to the material except for stating that the work was done in our laboratories.

The total gain, therefore, is measured by an increased volume of production plus the advantages of such a system in developing better men both as clinicians and as teachers.

RESEARCH IN CONNECTION WITH THE TEACHING OF ORAL SURGERY*

By E. C. HUME, D.D.S., Louisville, Ky.

THERE are so many problems which should receive the careful attention of research workers in this department that one finds it a difficult task to even mention them, to say nothing of giving careful detailed attention to all of them. I shall confine myself to the clinical phases of the subject.

Research in connection with oral surgery in dental schools offers a big field for the reason that so little has been done on many of our problems. The cooperation of other departments is essential in this work.

In the consideration of this subject, there are a number of questions which suggest themselves to the teachers of the oral surgery departments of any school:

1. What should be taught the undergraduate?
2. How best can we teach that which is attempted?
3. What are the sources of material for teaching?
4. Do our students get the practical application of what is taught?
5. What are the end results?

Much time could and should be given to the foregoing questions in our work at the various schools.

To make our research of value, careful detailed records should be kept of all cases handled in our clinics. Records should not only be complete in every detail, but they should also be indexed and filed so that they will be available for every member of the teaching staff of the school, without unnecessary loss of time.

Students should be required to examine patients and complete preoperative records as far as they are capable. This examination and record should be checked and completed by a member of the staff of that department. This record should contain, as a minimum, the personal history, physical examination and roentgen-ray findings, photographs and casts of the case before any operative procedure is instituted unless it is an emergency that demands immediate relief. When surgical procedures are instituted before the foregoing are secured, it is often impossible to get such data because the operation removes the very part that should show in the photograph, the roentgenograms or the cast. There is a wealth of material lost each year in most schools because the preoperative records are lacking.

I am told that some of our schools have no photographic department. If this is true, it is a lamentable condition which should be corrected at once. Modern photography is easily adapted to most of our work and a very small outlay of money is required for the necessary equipment, and but a few moments is

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needed to give us a lasting record of the preoperative appearance of a given case. With a room properly equipped, two or more views can be snapped in five minutes. For comparison with postoperative pictures, slides made of these are of great value later for teaching purposes.

Next, let us consider our roentgen-ray findings. If a pathologic process is present, we will carefully consider the tissues involved, keeping in mind that the operation later to be performed should, if possible, remove all hopelessly diseased tissue or provide drainage of suppurating areas. Study carefully the extent of such involvement; consult the roentgen-ray department and ask for their interpretation, and outline to students before opening areas the extent and condition that is thought to be present.

Next, let us consider the plaster casts. Here, we must have the cooperation of the prosthetic department. The details of this work are important and should be completed with as much care as in the making of a cast over which restorations are to be made. Casts should be mounted in their then anatomic relations (artificial stone is best for such casts because of its physical properties); a minute study of these mounted casts should be made and the variations from normal noted in the record. Here, we should consult with the prosthetic department again so that we will, as far as existing conditions will permit, have the case ready for the best possible replacement by that department after our work is completed. These plaster casts should be kept as a part of the permanent record.

After carefully evaluating all clinical and laboratory findings, a diagnosis is now made and recorded in ink. Then we proceed with the operative procedure, recording what is done, under what anesthetic, method of its administration, how it is done, conditions as found, and whether or not these agree with the preoperative picture.

Next, the tissues which are removed, hard and soft, should be turned over to the pathologic department for careful study. The record of this, along with cultures of fluids and examination of smears, should be attached to the record of the case. Parts of the specimen not used by the pathology department in arriving at a diagnosis should be preserved and used by the teachers of pathology instead of their using sections from distant parts of the anatomy, as is often the case. All of this should be carefully studied with the students, individually or in small groups.

Before the undergraduate is allowed to perform a surgical operation on live subjects, he should be taught the technic of such operations on the cadaver. After the preoperative work as above outlined is carefully followed out (the history of the case, physical examination and other points which he cannot get here are to be outlined by a member of the teaching staff to fit a given case), all other phases, such as the roentgen ray, etc., should be completed as if the operator were preparing to operate on a live subject. This work, if carried out under competent supervision, will enable the student to visualize the procedure which he is attempting to carry out. It will give ample opportunity to compare roentgen-ray findings with conditions as they exist. It will give an opportunity to put into execution what he has been taught in surgical technic. Seeing readily such structures as the mandibular nerve, vein and artery, the facial nerve, the facial artery and the maxillary sinuses, he will have a greater respect for them when he later attempts surgical procedures about the

mouth and face. There are altogether too many men attempting surgical procedures who do not respect the tissues on which they operate.

Postoperative care, including the postoperative roentgenogram, photograph and casts, should be a part of the record, and some one should be instructed to follow out the treatment as outlined, the results being noted on the record.

A definite hospital connection is not only desirable but an absolute necessity in the handling of many of our cases. Often, the physical condition of the patient demands hospitalization. In others, the magnitude of the surgical procedure is such that our patient must be confined in a hospital. The teaching staff of the oral surgery department should be members of the hospital staff with equal rights, privileges and responsibilities with the medical men on its staff. Consultation with medical men should be asked for and received so that our students may get the medical man's point of view; also in order that the student will know how to conduct himself after he graduates, when called in consultation or when he calls a medical man in for a consultation. Under no circumstances should a well trained oral surgery staff be secondary or subservient to the medical staff members. Our hospital connections should be definite; our relations to other departments of the hospital should be cordial and cooperative.

After several thousand cases handled as I have outlined, we could compile some statistics for the various surgical departments of our schools. We could, by comparison, arrive at some very much needed improvements in our work as teachers. We could arrive at a more definite method and standardization of what to teach the undergraduate, and how best to teach it. We could determine whether or not we put over our work to the students. By checking the records kept as outlined, we could determine the results from the standpoint of the patient; and results count.

Would not such a compilation, including photography before and after treatment, to be presented to the lay public, be of assistance in securing substantial endowments for our schools? This procedure has brought substantial donations to medical schools: why should it not bring like results to dental schools?

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Editorials

THE WASHINGTON MEETING

The Seventy-First Annual Session of the American Dental Association was held in Washington, D. C., October 7-11, 1929. In many ways, it was an outstanding meeting. As was natural to expect, the attendance was very large, and the general sessions and section meetings were crowded most of the time. The nation's capital is always a place of unusual interest, and this fact brought many people who otherwise would not have attended the meeting. The weather was ideal, which added much to the comfort of the visitors.

The Local Committee on Arrangements devoted themselves unselfishly to the task of looking after the welfare of everyone in attendance, and succeeded admirably. To stage a meeting of the magnitude of ours with all of its varied activities not only requires the devotion of each member of the Local Committee, but also calls for a high order of ability, and each succeeding year becomes more exacting in this particular. The members of the Association

at large have little conception of the unselfish sacrifice of these men; nor is this sacrifice confined to the days of the meeting. During the entire year preceding the meeting, they are called on to give of their time and energy, sometimes to the last limit of endurance, and this is in all respects merely a labor of love on their part. From the meeting itself, they derive almost no benefit except the satisfaction of knowing that they have contributed concretely to the advancement of their Association, which means the advancement of the profession. They are entitled to the thanks of the entire organization.

The President, Dr. Percy R. Howe, made an excellent presiding officer and conducted the sessions of the meeting in an able manner. During the entire year of his administration, he has devoted himself to the best interests of the organization, and has left behind him a most enviable record.

The Association was honored by the presence of distinguished members of the profession from abroad. Among others was Viscount Aguilar from Madrid, Spain, whose frequent presence at our meetings is always an inspiration; Dr. Chiavaro of Rome, Italy, the editor of one of the leading dental journals, and a man very prominent in his own country; Dr. E. J. van den Berg of Amsterdam, Holland, who was graduated some years ago from one of our American dental schools and returned to attend the meeting and tour this country; Dr. L. J. Mitchell, president of the American Dental Society of Europe, formerly of London, England, but now of Monte Carlo; Dr. E. M. Donahue, London, England, vice president of the American Dental Society of Europe; Sir Frank Collyer, of London, England; Dr. William Griswold of London, Dr. C. Cherpin of Paris, and others of note whose presence added to the international character of the meeting.

The general sessions were as always well attended, and the Tuesday evening meeting was exceptional in the character of the audience and the distinction of the speakers. It was held in Continental Memorial Hall. Vice President Curtis, speaking for President Hoover, made a witty and pleasing address. He was followed by Dr. Ray Lyman Wilbur, Secretary of the Interior in President

Hoover's cabinet, and chairman of the Committee on the Cost of Medical Care. There were also addresses by the three Surgeons General, Merritt W. Ireland, of the United States Army; Charles E. Riggs, of the United States Navy, and Hugh S. Cummings, of the United States Public Health Service. The evening was enlivened by music from the United States Army Band. It was an event not soon to be forgotten by those present, and when the report is published it will make interesting reading.

Another feature of this meeting was the attendance of thousands of school children at the motion picture and public health exhibits. This was made possible by the Local Committee through the hearty cooperation of the Board of Education of Washington, and was a real contribution to the health of the children of that city. If such a procedure is carried out in future conventions, it will undoubtedly have a far reaching effect on dental education throughout the United States.

The newly elected officers are: President, R. Boyd Bogle, of Nashville, Tenn.; President Elect, Col. Robert T. Oliver, of the U. S. Army Dental Corps; Vice Presidents, C. Willard Camalier, Washington, D. C.; H. J. Feltus, Baton Rouge, La., and A. E. Bonnell, Muskogee, Okla.; Secretary, Harry B. Pinney, and Treasurer, R. H. Volland.

Denver was selected as the next place of meeting.

OUR DENTAL SCHOOLS

At this season of the year when the professional schools of the land are getting under way for their winter course, it is well for us to check up on the present status of dental education to see whether we are advancing or retrograding; because there are those in the profession who can see little good in our present educational system, and who never lose an opportunity to find fault with it. Doubtless, there are many reforms that need to be introduced in our teaching methods, and no one realizes this more than do the teachers themselves; but in any great activity of life that has de-

veloped as rapidly as has dental education in this country, it is surely expecting too much to look for anything like perfection at this stage of its evolution. For dental education is less than a century old. At Baltimore, Maryland, on October 5 of the present year, there was dedicated a tablet to mark the site of the first dental college in the world, the Baltimore College of Dental Surgery, and this institution gave its first course of instruction in 1840-1841, just eighty-nine years ago. As every one knows, it was organized by Horace H. Hayden and Chapin A. Harris, and the introductory lecture was given by Harris, Nov. 3, 1840. It may be of passing interest to note that it was all they could do to muster a class of five students; and at the end of the first session, there were graduated just two. The lectures were given in a very modest building, and it is on record that the practical anatomy was taught in a secluded stable loft.

It might be well for those who constantly criticize the schools to pause and reflect on the development that has taken place in our teaching methods since that time. The curriculum of today could never be recognized as having the remotest resemblance to that of 1840-1841; it is many times more extended, more nearly complete and altogether better systematized. To compare the kind of instruction given in the first dental college with that of the better schools of today is to stretch the imagination to the breaking point; and this statement carries with it no reflection on the organizers of the Baltimore College of Dental Surgery. If ever a group of men deserved well at the hands of their profession in esteem, in admiration, in veneration, it is the small group of which Harris and Hayden were the principal characters, and today we bow our heads in reverence whenever their names are mentioned.

But it is safe to assume that neither of those men ever dreamed of the marvelous development that was to take place in dental education in less than one hundred years. How could they? Dental science had not at that time even caught the haziest vision of what was to develop in the years to come. At best, our teachers can be expected only to interpret the demonstrated knowledge of the day, and when the knowledge is meager, its interpretation must be like-

wise limited. And with the manifest expansion of dental knowledge, who shall say that the dental schools have not kept step with it?

If those who are inclined to reflect on the work being done in our schools would only take the trouble to follow the curriculum in any of our better institutions for even a few months, we feel sure that their opinion would be modified and their criticism less caustic.

As has just been said, reforms are needed today, and that this will come there is no question. One of the most insistent seems to be the necessity for concentrating more on attention to the teeth of children. The growing importance of this subject of children's dentistry makes it almost imperative that our colleges feature it more than most of them do today. If we are ever to prevent dental disease, or if we are even to control it, we shall do so only by early and constant attention to the teeth of children, and, to go further, attention to the influences at work before the child is born; and it is most important that this fact be stressed before the student during the whole course of his college training. In other words, children's dentistry should be featured much more than it is, and the student should be drilled in the best methods of coping with the various pathologic conditions that arise in childhood.

There is another feature of our college work that really requires serious consideration. We coddle the students too much. This may seem a peculiar statement, but what is meant is that we do too much of the student's thinking for him, and we do not soon enough begin to throw him on his own responsibility. Our chief aim in college instruction should be to develop the mental processes of the student, to teach him to think for himself. Giving a student a lesson to learn and then hearing him recite it in parrot-like fashion is not teaching him to reason, and unless we develop the reasoning faculty in our students, we are not training them properly. This applies particularly to instruction in the practical departments. Teachers are too prone to outline a course of procedure in a given clinical case, and then tell the student how the

work should be done. In the very early stages of instruction, this may be necessary, but there should be a constant effort to call forth the initiative of the student, and make him solve his problems for himself. As soon as he begins practical work, the procedure with every patient should be to compel the student to diagnose the case precisely as if he were in private practice, and outline his proposed treatment to his instructor. For the protection of the patient, the instructor should pass on the student's diagnosis before any service is rendered, and the student thereby has an opportunity to learn wherein he has erred. But the point is that he must first express an opinion of his own, and thus be compelled to think out his problems instead of having someone else do his thinking. There is nothing so subversive of individual initiative and mental development as to form the habit of relying on someone else to meet every emergency, and our students will never be properly prepared to face the issues of actual practice until we force them to cultivate independence of thought while in college. It will of course be claimed by many teachers that this is precisely what they are doing in their college work today, but we venture to believe that few of them stress this point sufficiently, and that most of them find it easier to decide a practical case for the student than to take the time to draw him out and elicit his individual opinion in the matter.

Minor reforms of this nature are needed in our schools and we trust that the day may never come when teachers will assume the attitude that reforms are not needed; but all reforms are more easily brought about by kindly and encouraging suggestion than they are by constant complaining, and we submit this to the critics of our dental schools as something worthy of their consideration. Helpful suggestion is stimulating and is productive of nothing but good, but the censorious kind of criticism that has so frequently been meted out to dental colleges is not only disheartening to college men but is also productive of very little benefit. Let us give our dental schools credit for what they have done, and perhaps it will be an incentive for them to do better.

I TALKED WITH AN OLD MAN

I talked with an old man the other day, and this is what he said: "You ask what I would do if I had my life to live over again? Truly, I don't know. With my present vision, I naturally think I could live a better life—I mean of course, a more fruitful life. I can see now where I have missed so many opportunities of doing good, and of this one thing I am convinced: the greatest joys of life come from doing good. By doing good, I don't mean what you probably think I do—I mean correcting a wrong, but not in such a way as to create another wrong. If anyone committed a wrong, I would not punish him for it in the usual way, because to do that would probably result in a worse wrong than the one I was trying to correct. Punishment never corrected anything; it usually merely complicates matters. I have watched the results of punishment a long time and I never saw much good from it. Our penitentiaries and jails have utterly failed to reform criminals, and so far as their punitive features are concerned, they are worse than failures—they are disastrous and terribly detrimental. Why they have been conducted as they have for so long a time I cannot understand. Maybe if I were a jailer, I could. I have no sovereign remedy for correcting our present abuses, but I know positively that we are not handling the situation correctly. It is an awful waste of energy and money, and we are accomplishing no useful purpose by it.

"A case reported in the papers recently appealed to me. A youth driving a car had been reckless and killed a man. The court granted a parole on condition that the young man should support for three years two children who were made fatherless by his carelessness. That is more nearly a just verdict than is usually imposed by a court. It is at least an attempt to compel the culprit to make restitution without at the same time demoralizing him.

"I spoke of doing good. Every day of my life I have had opportunities of doing kindly things that I have entirely overlooked, and therefore I have missed much happiness that otherwise would have come to me. I think possibly that I have been as kindly

inclined as most people, but that is not enough. It isn't enough to merely do the kind things that are put under your very nose; what you should do to gain the greatest happiness is to go out and look for kind things to do. Another thing, I have found that my purest joy has come from doing kindly acts when no one except myself knew anything about it. I have had some of my happiest hours in that way. I have now come to feel that if a day passes without performing some kindly unselfish act, it is a day wasted.

"As I look back over my life, I think my greatest sin has been narrowmindedness. My vision has been altogether too circumscribed and I have consequently permitted the small things of life to assume too much importance. How we magnify the minutiae! If we could only see far enough we would soon learn that many of the things that annoy us and cause us much unhappiness are so very inconsequential. Few of them are at all fundamental, and yet we foolishly permit them to interfere with our peace of mind. To be sweet and serene in the face of all sorts of annoyances is to gain the secret of happiness.

"I am sometimes appalled at the jangling and discord that I see going on—most of it without the slightest justification. I have jangled myself when I was younger, but I never got the smallest atom of satisfaction from it. I think that I always felt a little foolish after every display of temper, and as I look back at it now, I know that it was the utterest folly.

"Another of my greatest mistakes has been worrying about things. The hardest lesson of my life, as I look back at it, has been to avoid worry. Try as I would, that demon often got the upper hand of me. Don't think I am claiming that there is never any cause for worry—there is. Nor does it suffice to say that we never get any benefit from worry. Of course, everyone knows that, but it doesn't seem to help the situation. My only reflection is that most of us indulge in worry more than we need to, or more than is sensible. It all comes from a distorted view of the real values of life. The situation therefore resolves itself down to narrowness of vision on our part. If I had my life to live over again, I would try to be bróader minded.

"Of all the mistakes that I have witnessed among people, the worst one is that of seeking revenge for an injury. Revenge is always disastrous. It never accomplishes any good thing and invariably works harm. It injures both parties—most of all the one who seeks revenge. However much it hurts the victim, it does the most appalling damage to the author of it. There is a moral disintegration of character in every case of revenge, and there is never the slightest benefit. Even the worst character in the world was never really happier after he had revenged himself on his enemy. What a world this would be if all the revenge and hatred were taken out of it! We wouldn't want any better heaven than this.

"Another mistake that I have made is in misjudging the motives of people, and that is a terrible wrong. We often pass judgment on surface indications without knowing all the facts, and we thereby get into much trouble. We should know the whole truth before we judge people, and even then we should hesitate. There may be certain things about the case that we cannot know, and we never make any mistake by reserving judgment.

"If I had my life to live over again, I would be more charitable of the faults and frailties of others. There may be something back of every misdemeanor of which we know nothing—we are never quite charitable enough. Often, we should sympathize with a man who does a wrong rather than censure him. If we carefully analyze our own conduct, we shall see that we really need charity for many of our tendencies, and we should be big enough to grant to others every favor we ask for ourselves. It all goes back to narrowness of vision, and that seems to be a part of human nature.

"Another thing: if I had my life to live over again, I would laugh more than I have done. Laughter is the blessed balm that eases the sorrows of men and lets the sunlight into their souls. It spreads a gleam of brightness over the rippling rivers of life, and flashes back a glow of joy for every human heart. It eases the stress and strain of our existence, and lets us relax from the stern realities of our work-a-day world. It breaks the chilly ice of reserve, and even beats down the rising tide of resentment and sus-

picion and hate. I would have the people of the world laugh more than they do, and sever the bonds of solemnity and lugubrious gloom. Our heritage was happiness, and we should enter into it through the portals of laughter.

"On the whole, I've concluded that this is a pretty good old world after all, and I am grateful for the privilege of living in it as long as I have—I'm over 80, you know. And I wish I could live it all over again."

And I thought that if every man could come to the age of 80 with the cheering philosophy of my friend, the problem of life would be more hopeful, and the happiness of people more assured than it is.

RELAX

To learn how to relax is one of the most difficult lessons of modern life, and one of the most essential. We go along at high pressure at all times, and unless we are able to relax, we ultimately blow up. To relax properly is a science, and it is also an art. Few modern men are apt at it. The present tendency is to go the limit and never look back — never even pause by the wayside — and the inevitable result is a break. We do not stop to think that there is a limit to human endurance, and that everyone reaches the limit if he keeps on long enough. To relax sometimes is to do better work the rest of the time. We must not forget that we shall never be able to do all the work there is, no matter how hard or long we apply ourselves. Let us aim to achieve moderation in this as in all the activities of life. There are times, of course, in the exigencies of our present stage of civilizaton when we cannot escape the stress and strain of circumstance and chance; we may as well realize this and submit to it—we cannot play the game without it. But it is all the more essential that we counteract this pressure by periods of relaxation. Any other philosophy is false and futile. Let us learn to relax.

BUREAU OF CHEMISTRY

RADITHOR

INQUIRIES have been received by the Bureau concerning Radithor (Bailey Radium Laboratories, Inc., East Orange, N. J.).

Claims made for Radithor range from anemia to skin disorders, including dental disorders. The promoters of Radithor have such regard for their product that it is advocated for the following disorders:

> Anemia, Arteriosclerosis, Arthritis, Catarrhal conditions, Diabetes, Dental conditions, General debility, Goitre, High blood pressure, Menopause and Menstrual disorders, Nephritis, Neuralgia, Neurasthenia, Neuritis, Nervous conditions, Obesity, Prostatitis, Rheumatism, Senility, Sexual conditions, Skin disorders.

Such a list in itself is enough to cause one to look askance at the product. It is a well-known characteristic of the proprietors of such products not to be modest in claims but to add claim upon claim *ad nauseam*. Radithor apparently is no exception to this rule.

Radithor, it is claimed, is perpetual sunshine. How Radithor works is best described in Mr. Bailey's own words:

> The radioactive water that produces the perpetual sunshine . . . is known as Radithor. It is a combination of actual radium and mesothorium scientifically incorporated with pure triple distilled water. By merely drinking Radithor, the radioactive elements are distributed throughout the whole body where they shower their billions of rays on the cells to stimulate their function.

Having considered Radithor and its claims, it is not amiss to consider the history of the Bailey Radium Laboratories and the claims for this product. *The Journal of the American Medical Association* stated several years ago:

> Radithor is the name of the latest nostrum in which William J. A. Bailey is interested. It is being exploited by means of elaborate booklets, and also through what purports to be a book, entitled, "Modern Rejuvenation Methods," by one Charles Evans Morris, M. D. The "book" by Morris is so obviously a piece of commercial puffery that even the most unsophisticated can hardly be deceived.
>
> Radithor is exploited by the somewhat imposingly named Bailey Radium Laboratories of East Orange, N. J., of which William J. A. Bailey seems to be the chief. Bailey is not a physician, so far as our records show. Two or three years ago Bailey was president and one of the incorporators of the "Associated Radium Chemists, Inc.," which put out "Arium Tablets." At that time the Associated Radium Chemists, Inc., seemed to do business from the same place that the Vitamon Corporation and the Mastin Company exploited their "patent medicines." Bailey also, it appears, was connected with the Thorone Company, a New York City concern which sold "Thorone Tablets," claimed to be the "Formula of William J. A. Bailey" and to be "250 times more radioactive than radium." Later, Bailey was connected with the American Endocrine Laboratories. This concern exploited what was originally called the "Radiendocrinator," a high-priced piece of hokum that sold first for $1,000 and later for $150.
>
> In 1915 one William J. A. Bailey was connected with the Carnegie Engineering Corporation in New York City. This outfit was declared a fraud by the federal authorities in September, 1915, and we learn from the federal officials that, in December of the same year, this William J. A. Bailey went to

the "Tombs" for thirty days, on a charge of violating the United States laws.

And again in an editorial entitled "Fee Splitting Quackery":

"Radithor" is one of the numerous pieces of quackery in the field of radioactivity. It is exploited by the Bailey Radium Laboratories of East Orange, N. J., the moving spirit of which is one William J. A. Bailey, whose past record with "patent medicine" concerns and a fake engineering corporation was dealt with. The Radithor quackery consists of thirty half-ounce bottles of distilled water which is alleged to be radioactive. No less than thirty bottles can be purchased; and the price is $30. That is, the price to the sucker who happens to be a layman is $30; to the easy mark who can write M. D. after his name, it is $25. There are two order forms, one, the "Standard Order Form" that the layman fills out; the other, the "Special Order Form for Doctors' Use Only." This form states that "when patient buys direct, we allow doctor a $5 credit on all orders." The physician who would order Radithor must be weak not only in medicine but also in morals.

The history of the Bailey Radium Laboratories, Inc., and those connected with it is not so inspiring as to engender confidence in their product, Radithor.

But even if Radithor was exploited under less suspicious circumstances, the value of water which has been exposed to sources of radioactive rays is of no account. The following editorial comments from *The Journal of the American Medical Association* pointedly summarizes the lack of therapeutic usefulness of radium solutions:

The evidence in support of the contention that radioactive drinking waters are useful for the control of disease or for the benefit of human health has not been profuse in amount or inspiring in scientific value. Indeed, a survey of more recent publications inclines to a dismissal of the entire matter as unproved and unsubstantiated. For this reason, no doubt, the Council on Pharmacy and Chemistry has issued the following statement:

"From an examination of the available evidence, it appears that the value of the internal use of radium solutions or of water containing radon in chronic arthritis, gout, neuritis and high blood pressure is not demonstrated by controlled clinical evidence; that in spite of many years of trial, acceptable evidence has not become available and until such evidence does become available the Council has decided not to accept generators for the production of water charged with radon or radium solutions intended for intravenous use."

The announcement by the Council on Pharmacy and Chemistry disposes of the claims

Actual size of Radithor container.

made for all sorts of solutions and for the devices to be used in preparation of such solutions, whether they contain considerable amounts of radium or merely enough to confer activity resembling the flavor of chicken soup when the chicken has had to do double duty as stewed chicken and chicken soup flavor. Today there are offered both to physicians and directly to the public solutions of radium and of radon, for drinking, for bathing and for injection, with claims of virtue not only in the conditions mentioned in the report of the Council but also for anemia, rejuvenation, regeneration, leukemia,

boils, blackheads and pimples. Rejuvenation has become a catchword for promoting all sorts of strange preparations and apparatus. The venders capitalize suppressed wishes and desires and exploit all that the power of suggestion is able to do for the impotent. This they do, let it be emphasized, whether or not the devices provide any considerable amount of radium activity. But the statement by the Council settles the matter regardless! In one of the dialogues of the two Black Crows, Moran imitates the blowing of a trumpet. After a few moments Mack says: "Even if that was good I wouldn't like it." Of the radioactive drinking waters it may now be said: "Even if they did have some radioactivity, there is no evidence that they would have any value."

To further comment on the product or its exploitation would be like refining fine gold or painting the lily.

BUREAU OF DENTAL HEALTH EDUCATION

PREVENTIVE DENTISTRY

By GURDON R. MacKAY, D.D.S., Boston, Mass.

WHEN dentistry became an organized profession in the United States, less than 100 years ago, the principal thought in the mind of the practitioner related to methods of supplying substitutes for teeth that were lost. Some attention was given to the subject of operative dentistry, but preventive dentistry was rarely mentioned and the filling of teeth was of secondary importance. With the passing of time and the acquisition of knowledge through the research laboratory and by clinical experience, we are confronted with the important problem not only of saving the natural teeth, but of doing so in a manner whereby they will not become a menace to the general health.

In the past decade or more, an entirely new problem has arisen in the practice of dentistry—the problem of the pulpless tooth and its relation to general health. This has greatly increased the responsibility of the dental practitioner, and has greatly stimulated the interest taken in dental pathology by the general practitioner of medicine. It is generally conceded by the practitioner of dentistry that the object of first importance is the preservation of the natural teeth. The purpose of this paper is to discuss a system of practice which, if adopted and conscientiously followed, will produce the greatest results in the direction of prevention. Today, operative dentistry is the most important specialty of the dental profession. The other branches of the profession, with the exception of orthodontia, are principally needed when operative dentistry has been neglected. We hear much at the present time of preventive dentistry and preventive medicine, but do we concentrate sufficiently on the problems of our profession that have to do with real prevention?

The scientific side of dentistry is being developed in an intensive manner at the present time, with the hope that something of a positive nature will develop in the near future. If we should discover the true cause of dental caries, and, by diet or other means, we could prevent this condition, a new era in dentistry would open and the amount of practical work necessary be reduced to some extent. With this knowledge acquired, we would still be confronted by the problem of its adoption by the general public. Rules and regulations are not popular with the average individual, and we would still be obliged to resort to reparative operations in the mouth in order to deal with the situation. Let us review what we have on the scientific side as a means of prevention. The operator who does not make use of all knowledge in this direction is falling short of his best usefulness. First, we have prenatal feeding. Attention to the diet of the prospective mother is

very generally recognized as having an important effect upon tooth development. The diet of the child after birth and in early life is also believed to be an important factor in the formation of better teeth. We also have prophylaxis as practiced in the mouth by keeping the teeth and mouth as clean as possible. The proper observance of oral hygiene by this means is probably one of the most effective means of prevention having a scientific basis. When we have exhausted our scientific knowledge, we believe that we have prevented decay to some extent, but after all is done in this direction, we are confronted with the fact that we have only been slightly successful in doing so, and that the disease progresses to an alarming extent in many cases. What, then, is the final remedy for the situation according to our present day knowledge? We must depend on skillfully performed operations in the mouth. This work must be given attention early enough in life to check decay at the beginning, and sufficiently often enough thereafter. The child should be seen at 3 years of age and at least every four months thereafter. This can be easily done with children born within one's practice, if we have properly educated the parents. This brings us to an important phase of the situation: namely, control of our patients. This is all important, for without it the system would be a failure. When a patient consults a physician, the first thing done is to make an examination in an effort to find the disease. After this is accomplished, the patient is given certain definite instructions that he must follow if any benefit is expected from the treatment. Why, then, should we examine our patients and dismiss them with but vague instructions for the future? They should be impressed with the fact that regular and frequent visits are necessary for the best results. Intelligent people are quick to recognize the benefit from this treatment, especially when the test of time is applied to prove it. All patients should be seen at least three times a year. Their names should never be off our records and a regular system of notification should be installed. Perhaps this might seem arbitrary to the patient of the young practitioner, but he should work with this end in view: to educate his patients to the point where they will see the great advantage of this method of practice. It is only by this means that deep seated cavities can be avoided, and these not only weaken the teeth structurally but are the principal cause of pulp devitalization, being responsible for the most serious condition in dentistry. Not only are the teeth infected and lost in many cases, but they also become an important source of disease in other parts of the body. On the first visit, prophylactic care should be given. This should be done with the greatest thoroughness, for if properly done it is a preventive of dental disease and is also important from a general health standpoint. The removal of deposits from beneath the marginal gingivae keeps that tissue in a healthy condition, and is one of the best means of preventing pyorrhea. For the patient whom we get at any age and in any condition, the first step should be to place the mouth in as good condition as possible, if that should take one month or six months. After this has been done, the patient should be notified once in four months. If proper skill and judgment has been used in the performance of this work, there will be no difficulty in keeping the mouth in perfect condition indefinitely. This brings up the subject of the quality of work necessary to save

teeth. It is impossible to conceive of any occupation which requires greater accuracy than the practice of dentistry. The absence of this one characteristic is accountable for many failures in dental operations and consequent suffering on the part of the patient. To countenance any inaccuracy or weakness of purpose in the practice of dentistry is to follow the line of least resistance, and will certainly lead one in the wrong direction. It is a question of temperament, then, as well as proper skill, which must go hand in hand in order that the patient shall receive the greatest benefit. Judgment must be used in the selection of materials, and those materials must be properly placed where indicated and in accordance with the best ideals in dentistry. We sometimes hear the assertion that to do thus and so would take too much time and that certain methods must be followed in order to see all who apply to us for treatment. The chief concern of the dental operator should be quality rather than quantity. Any practitioner of dentistry is well aware of the continuous pressure leading him away from his best effort, and those who can the more successfully resist this influence will render their patients the best service. The greatest good can be done the greatest number by correct proceedings in all directions. This does not always mean more time, as the operator accustomed to accurate methods finds it an easier task to do everything well. The result of operations in dentistry becomes manifest at some time in the future, and if the highest ideals of the profession are not carried out at the beginning, security will be of short duration. Consequently, we should aim for permanent results by using the best effort possible. If this should consume more time at the initial operation, less time will be required in a decade, as it is not necessary to repeat the same operations so frequently on account of the lasting qualities of work well done. The temperament and character of the operator comes to test here: shall he decide on that which is easier and sometimes more pleasing to the patient, or adhere to the best principles of practice and in the end render the greater kindness to the patient?

Better dentistry clubs are being formed at the present time, and I believe a more universal recognition of this phase of dental practice is going to develop in the minds of practitioners in the near future. This will lead to the education of the public as well, to the end that they will appreciate the value of sound teeth, and that this condition can be maintained only by the best service.

Dentistry is passing through an evolutional development which bids fair to continue until its great importance from the standpoint of public health is fully recognized. The educational requirements for the study of dentistry have been increased to a point in keeping with the recognized importance of dentistry as a profession. This will materially aid in bringing the best men to the profession, and, consequently, increase the quality of service to the public.

SUMMARY

We should recognize and put to practical use all scientific knowledge available. Children should be seen at 3 years of age, and all patients should be seen at least three times a year. The practitioner should assume control of his patients and be responsible for the regularity of their visits. They should be instructed in this direction in order that they may see the great advantage of this method of practice. All cavities should be filled at their beginning and not be

allowed to become deep seated. The best filling materials should be used with the greatest skill possible. I have seen at least one generation grow to maturity in whom an attempt was made to follow this line of treatment, with results sufficiently convincing to warrant the belief that this is true preventive dentistry according to our present-day knowledge.

333 Commonwealth Avenue.

DENTAL HEALTH ACTIVITIES IN THE PUBLIC SCHOOLS*

By C. CARROLL SMITH, D.D.S., Peoria, Ill.

ARTICLE 17 of Section 115, which was added to "The School Law of Illinois," June 19, 1927, provides for the employment of dentists to carry on mouth hygiene service among pupils in the public schools of the state.

RESPONSIBILITY

This legislative act places an immediate responsibility on the dentists of every community. A well organized dental health program that will bring cleanliness, physical fitness and respectability to a system of education is a service of value to the youth in the schools, and to the community at large. Wherever there is a public school system, large or small, would it not be fine if the dentists resident in the community were to accept cheerfully their opportunity by encouraging an educational régime that would at once conserve the health of the coming generations now in intellectual training?

OPPORTUNITY

The influence of dental health measures as an important consideration for the physical and mental fitness of our future men and women must be intelligently brought to the attention of the people. The recent school law makes it possible to reach the pupils in our schools with a constructive program which they may carry into their homes. We have a wonderful opportunity. Will we take advantage of it, and provide instruction along dental health lines that will produce a better physical and mental development, thus adding to civic betterment and conservation of the health of the people?

SERVICE

Every child has a right to sound mouth tissue and equipment in connection with a normal, well-ordered body. This is essential in order that his intellectual development may proceed unhindered by distress, abnormality, disease or neglect. The dentist has a valuable service to render to his community, a service that will increase the efficiency, improve the health, and add to the pleasure and personal appearance of those whom he serves.

PROGRAM

If the largest degree of service that our profession has to offer is to become a reality, a program must be prepared to coordinate with the educational system that is training our boys and girls to assume the responsibilities, and set

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the standards, of the years to come. This public school dental health program presents a three-fold prospect, including instruction, inspection and dispensary service.

INSTRUCTION

First of all, the public school is an educational institution. All methods used in connection with its functioning should be constructive, helping the child to discover and develop his highest possibilities. Our normal and college training schools have produced methods that are peculiarly fitted to reach the mind of the present generation. It will be wise for the dental profession to make its public school program conform with modern ideas of instruction as developed by these special schools. The science and pathology of dentistry, as well as its technical terminology, and professional nomenclature, are contraindicated in connection with a dental health program in the grades. Simplicity is always the best approach to the child mind. Profundity is never desirable. Much zeal and effort have been without effect in the school systems because conscientious and ambitious dental health workers have not fitted themselves for their suggested programs through a study of methods, language and subject matter used in the modern class room.

The Mother Goose series, and other child literature, furnish a wonderful channel for presenting dental health ideas to the very young. The game, the shop, the domestic science circle, the physical education program, art, history, geography and supplementary reading are all means to an end to be used in furthering instruction along lines to improve health, build strong bodies and establish mouth hygiene. The dramatic opportunity in the schools is also a valuable channel for spread of the propaganda of the clean mouth in a well nourished body. To produce a normal and well-sustained physique, two things are essential: good health habits and intelligent selection of body building foods. To bring these to the attention of the pupil, and emphasize their importance through a modulus acceptable to the child mind, is the problem to which dental health instruction must lend itself.

SUBJECT MATTER

Since the establishment of a division of mouth hygiene as a part of our state department of health, much excellent subject matter has been developed along these lines. I am not unmindful of the educational value of the material that has been produced by those active in this department. It has been extensively used throughout the state, with gratifying results. But there is yet to be developed a graded course of educational matter, beginning with the kindergarten, and running through the eight grades, that will definitely fit in with the modern class room methods employed by the trained teacher. Supplementary reading which anticipates the child vocabulary for each grade is a much needed help that would be welcomed by all school systems. Busy work, something for the hands to do, that is so completely organized as to not burden the teacher, nor take too much of the pupil's time, is another grade-by-grade need.

The educational value of "The Sells-Health-O Circus," as developed by Dr. and Mrs. Lon W. Morrey, is an outstanding feature. It should be used by every community in the state. We need more playlets of this character, perhaps with simpler accouterments so that the equipment may be easily produced on the individual fields.

AVAILABLE MATERIAL

The dentists of every community should get behind an educational program for their schools. They will find material available from the division of mouth hygiene of the department of public health at Springfield, from the Bureau of Dental Health Education of the American Dental Association and from the National Dairy Council. The mothers' clubs are a fruitful field for the dissemination of dental health information. With the material produced by the Chicago Dental Society for help in making talks to civic bodies, there should be no excuse for any community to go uninformed along these lines.

COOPERATING AGENCIES

The division of mouth hygiene of the state department of health, in conjunction with the committee on mouth hygiene and public instruction of the state dental society, is on the threshold of a great opportunity for service. With our two state dentists on the staff of the state health department, and access to the services of state health nurses, an advisory service will soon be available that will mean much to the educational program for mouth hygiene in the public schools of Illinois. This bureau of dental health at Springfield, cooperating with an active committee on mouth hygiene and public instruction, ought to place the Illinois State Dental Society in the foremost ranks of those active in dental health educational matters. We are looking to the state department of health and to the state dental society for an extended and efficient program.

INSPECTION

That the public school is primarily and always an educational institution should be borne in mind, and the next division of dental health activity should be the regular dental inspection of all pupils, with an adequate follow-up program. Good work along this line has been going on in the state. The day is not far distant when every school in every community will have its stated dental health inspection. This inspection affords an opportunity for instruction to the pupils, and carries with it a means of reaching out into the homes, through literature and notices sent through the pupils to the parents.

PRESCHOOL AGE

It is important that inspection begin with the child of preschool age. The agencies that foster a preschool age clinic once or twice a year are rendering a valuable community service. As a rule, at these preschool age clinics, the mother is present with the child. This affords opportunity to give personal information first hand for the child's benefit. Parental love and pride are at once awakened to the need and desire for service on the child's behalf. The next important steps are the first and the subsequent visits to the family dentist. A first-class dentist is the one who is glad that the child is getting a square deal through early attention to his dental needs. This type of dentist responds with pleasure when the mother appears. He either does gladly what is to be done for the child, or gets him in touch with some one who will take care of him.

DIAGNOSIS

Perhaps the diagnosis of the examining dentist does not meet with the approval of the family dentist. In order that the best interests of all concerned may be protected, it seems that the preliminary examination should be of such a nature as to impress the mother with the fact that her child needs dental attention. Plenty of leeway should be left in the

examination to allow the operating dentist the privilege of giving the final decision as to the nature of the service to be rendered. With malice toward none and charity for all, let us not be too sure that the mother always carries out the examining dentist's idea exactly as he intended it. Surely he has made the examination with the good of the child in mind, and he has no motive other than getting the child in touch with dental service at the hands of his own dentist. If some vague, unheard of or irritating diagnosis is voiced, sprinkle your judgment with a grain or two of salt, withhold condemnation and irritation, get in touch with the examiner and good-naturedly ascertain what he had in mind. You may find that his best intentions miscarried, or some new light may be obtained on service necessary for the child.

THE CHILD COMING INTO HIS OWN

The one great disappointing result of these inspections is the fear or the unwillingness of some dentists to work for the preschool age or even the grade-age child. It is gratifying to note that these disappointments are growing less, and that more dentists are realizing the importance of, and are more willing to serve, the child patient. Some wonderful dental preventive measures are being taken for children of the younger ages. All honor to the dentists who are friends of the children and who begin this friendship with an appreciation of the needs of the preschool child. Service to humanity in the early developmental period dignifies dental health efforts and brings the reward of a partnership in the conservation of the interests of little children, the bulwarks of society.

DISPENSARY SERVICE

Third in this dental health program is the dispensary service for the financially embarrassed. The public school is not a charitable institution; but incidentally with the inspection and education, a public school clinic can scarcely be omitted. It would be impossible to carry on an extensive practice of dentistry in the schools. But in order that the child of the unfortunate, or indigent, may be given the full privilege of his educational advantages, it seems necessary to carry on a limited amount of dental service for those who cannot possibly secure the service elsewhere. Only the simplest preventive measures can be undertaken, if all concerned are to be treated fairly.

THE INCENTIVE

Experience in many school clinics over the land has proved that prevention rather than repair, comfort rather than suffering, cleanliness rather than disease, are the incentives that govern the activities of the school dispensaries. The very poor must be kept physically and mentally fit in order that they may be free from the detrimental influences that would hinder their grasp of the fundamental principles of an education. To this end, the school dentist serves in the dispensaries, at the same time educating his patient to an appreciation of dental health, inspiring him to independence and encouraging him to endeavor to find a way to purchase good dental service with his own savings.

CONCLUSION

In the final analysis, there is nothing new in this paper. But the matter of mouth hygiene for public benefit must have continuous consideration. Enough material has been developed along lines of oral hygiene to almost heal the situation. My files are crowded with excellent material and suggestions, but little of it fits into the public school situation as it exists today. The suggestions that

would seem to harmonize with the system require the expenditure of funds that are not available. One unfortunate circumstance in the matter of progress in establishing and carrying on dental health activities in school systems is the political trend, which results in frequent changes in the personnel of boards of education. Very often, when salesmanship has done its best to initiate some little start toward dental recognition, the school election campaign becomes so intense as to retard progress, political history repeats itself before matters can be brought to a focus and the process must begin all over again.

The cause of mouth hygiene is essential to the highest efficiency of the human race. The importance of its inculcation as a definite part of the public school curriculum is beyond question to those who understand the situation. It is for the dental practitioners everywhere to awake to their community's need and provide for the pupils in their schools. Every community has problems peculiar to itself which must be studied and solved by those at practice on the field.

It is imperative that the Illinois State Dental Society and the Division of Mouth Hygiene of the Illinois State Department of Health perfect a system that will serve the schools of the state acceptably in dental health education, in inspection and in dispensary service.

THE BEST WAY TO SERVE THE CHILD DENTALLY*

By F. BLAINE RHOBOTHAM, D.D.S., Chicago, Ill.

THE problem as to how best to serve the child dentally goes back to the origin of the child, its forebears; for the type and quality of teeth are greatly influenced by the physical stamina and characteristics of the parents. It has been well said that to insure good teeth one should select grandparents well fortified with perfect masticatory apparatus. Of course, we cannot choose our grandfathers and grandmothers, but we certainly hope to be that third generation some day ourselves, and we can therefore do much for those grandchildren that are to be ours.

Strong bodies are the result of hygienic living, plus good physical heredity, and the teeth are a very important part of that bodily mechanism, in which we live and do or fail to do. Cannot it be well said, then, that one of the essential means of serving children dentally is to keep strong bodies as progenitors, and to maintain healthy environment in the child that its teeth may have the opportunity of normal development?

The general health of our nation has been steadily improving, especially during the past thirty years. This is not only proved by our young people of 60 and 70 today, but statistically the span of life has been increased many years.

This statement is an apparent contradiction to the opening argument in view of the fact that teeth have not shown a similar improvement. There really is no conflict in the stated facts. There is need for explanation, however. In the first place, one of the constructive forces in improving health and prolonging life has been the better care of the oral cavity. The effect of this war on

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focal infection will be reflected, first, on the general health and, finally, the teeth as a part of the body will be benefited.

In the second place, there has been a gradually receding use of the teeth as the result of the refinement of foods. Added to this, the increased consumption of sugars and the artificial feeding of babies are the main factors that have been defeating what has been gained in the other direction.

In a general way, then, let us recommend, as of prime importance to the child dental patient, that we continue to improve our hygienic program for general health and pay particular attention to these newer problems that need solution. Let us recommend more vigorous use of the masticatory apparatus, a return to coarser and unrefined foods, a restriction of overconsumption of sweets, and urge mothers who can to breast feed their babies until they are at least 9 months old.

Our second great problem to solve is caring for the actual difficulties that arise or have arisen in the child's mouth. Unquestionably, our greatest obstacle to overcome is caries and its sequelae. We have made wonderful strides in our profession, but we have failed miserably in our studies of this the most fundamental of our research endeavors. We suggest a concentrated effort in the study of caries and its control as one of the best ways of serving the child dentally.

Facing conditions as they exist today, unquestionably the greatest service that we can render the child is to consecrate ourselves to the task of caring for him dentally, with the knowledge that we have at hand. This amounts to having the value and necessity of children's dentistry stressed in our dental literature and in our dental societies; for we must arouse our own profession to its needs, first, and then, by mutual aid, work out the best means of treatment. The universities are improving the facilities for teaching children's dentistry, but what about the men who are now in practice who have not had the opportunity for competent training?

While we are waiting and hoping for this improvement, we must enlighten the public as to the benefits to be derived from early care of the teeth. I fear the public is ahead of the profession in this respect, and it is high time for us to prepare ourselves to meet the demands for more and better service.

When we reach the coveted goal, where we will insist on early and regular dental care for children, we shall not only be a force for the general well-being of child life, but we will also have our efforts reflected in a healthier and happier adult public.

We cannot begin early in every case and carry it on ideally, for we must also care for the already neglected cases. We must attack infections arising during childhood, with all of the vigor and enthusiasm that we exhibit in caring for the mutilated mouth of the grown-up. There can be no question as to the devastating effect of streptococci and their toxins as they seep into the blood stream from about broken down deciduous teeth and seek more fertile fields in the viscera, yes, in the very hearts of tender youth.

There can be no question that tuberculosis wends its way through hollow teeth and roots and becomes enmeshed in the cervical glands, there to bring vengeance on its captor. There can be no question that unspeakable horror and pain must be endured by the most treasured gift to man, because of neglect.

How can we best serve our child patients dentally? By a solemn resolution that we will seize every opportunity to develop in ourselves a better understanding of our problem; and, further, that we will give of our knowledge freely and often to the guardians of these children, and will care for regularly and thoroughly every child that comes within our province.

55 East Washington Street.

COOPERATION OF THE FAMILY DENTIST IN THE MOUTH HYGIENE MOVEMENT*

By R. C. WILLETT, D.M.D., Peoria, Ill.

IT was about twenty-five years ago that the examination of public school children's teeth became a practical part of the social service work of many dental societies, and it was through those examinations and the tabulation of their findings that the mouth hygiene movement was started. This movement is slowly but surely educating parents in regard to the close relationship between dental health, general health and mental growth of their children.

These examinations, conducted by dentists appointed through local dental societies, proved that in almost every locality from 95 to 98 per cent of school children had tooth defects. Many of these children belonged to families who could well afford to pay for dental service, while many others, especially those attending schools located in congested city districts, were from families whose earnings barely covered actual living expenses.

Aside from determining the percentage of children having defective teeth, the tabulation did not reveal anything of special scientific value, but it did prove the need of extended dental activities in several lines.

1. Scientific research to determine the cause of so high a percentage of defective teeth.
2. Education of dentists to the necessity of more thorough treatment and prophylactic care of children's teeth.
3. Directing of parental attention to the importance of prophylactic dentistry.
4. Establishment of public dental infirmaries where the children of indigent families could be taken and where such children could receive proper care.
5. Bringing to the attention of public school boards the economic value of such mouth hygiene services, and gaining their financial support of the work.
6. Employment of public health nurses, competent to carry on the examinations of public school children's teeth, and to aid in mouth hygiene educational work.
7. Employment of dentists thoroughly competent to conduct and to supervise dental dispensaries.
8. Financing of free dental dispensaries in connection with public charities.

Any purely scientific interest taken in those first examinations of public school children's teeth was quickly relegated to second place through the alarm aroused by the findings, and, in the twenty-five years since then, the eight problems just enumerated have been fairly well worked

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out in many localities, and the value of such social work fully proved; but we are finding serious obstacles in the way of further progress, and the object of this paper is to invoke aid from the family dentist in their removal.

After an examination of the child's teeth has been made by the school dentist, or by the public health nurse, and the recommendations for needed dental care have been sent to parents, the family dentist frequently neglects his duty to complete the program by rendering thorough and unrestricted dental service. Such neglect is evident even though parents are able and willing to pay reasonable fees for whatever dental work their children need. As a fact, the dentist who performs his full duty in the mouth hygiene movement, by the execution of thorough dental service, thereby sustaining and endorsing the work of the examining dentist or school nurse, is still the exception rather than the rule. I know this to be a fact from my daily contact with mouth conditions in children, and my contacts with many public health employes further confirm the truth of my statement.

In every case in which the family dentist fails to receive thankfully the recommendations of the school dentist or the public school nurse, and does not give complete dental care to the child patient, there is an invalidation of a great humanitarian service, and the mouth hygiene movement falls down.

Since the progress and even the continuation of the mouth hygiene movement are at the mercy of the ever-changing personnel of public and civic governing boards, the family dentist should not allow his personal interest and influence to lag. Two outstanding examples of mouth hygiene activities have gone on the rocks because dentists in those particular localities have failed to keep the in-coming members of public school boards alive to the importance and duty of maintaining a high standard of mouth hygiene in the public schools.

At present in many localities, children of school age, beginning at the age of 6, are receiving dental attention, but the cases so far are exceptional in which the social work has reached those of earlier years. In a recent conversation, C. Carroll Smith, Peoria public school dentist, replied to my question as to where he found the highest percentage of tooth defects by saying that it was found in deciduous teeth existing in children between the ages of 7 and 8.

Dr. Smith's observation corroborates an investigation which I conducted personally a number of years ago. Four hundred children were selected for examination. One hundred were 6 years of age; 100, aged eight; 100, aged 10, and 100, 12 years old. A careful tabulation of the results of these examinations revealed the startling fact that four times as much decay developed between the ages of 6 and 8 as occurred between the ages of 8 and 12. This would indicate in no uncertain way that if we are to reach them, the care of the most incipient defects of deciduous molars must begin in children of preschool age, and our most careful and persistent attention should be directed to children entering kindergarten.

When we bear in mind the fact that deciduous teeth sometimes erupt with defective enamel, the importance of the examination and care of them long before the child attains school age should be self-evident, and on this point the family dentist should speak "as one having authority." He should sternly admonish his parent patients that the sacrifice of a "baby tooth" before the

permanent one below it is fully formed and ready to erupt leaves that space in the dental arch without proper occupation, a condition which invariably seriously affects arch formation, a defect leading to malocclusion of the permanent teeth and to actual deformity.

Frank A. Delabarre, in an article entitled, "The Problems of Prevention," [1] says: ". . . better health can be assured more people by means of children's dentistry than in any other way." He adds, "The task of educating the public should be easy . . . But all effort in that direction should be supported and sponsored by *responsible dental organizations,* and not left to individuals or unprofessional bodies.

As a result of the mouth hygiene movement, parents at the present time are generally fairly well informed as to the importance of early attention to, and skilful treatment of, developmental defects of the first permanent molars, but as yet few realize the necessity of thorough care of the deciduous molars and the important relation their function bears to normal arch development and skeletal formation of the jaws and facial bones.

This lack of information is due to the fact that the child of preschool age has not been reached through the organized mouth hygiene movement and that the family dentist has not as yet stressed the importance of the early and complete restoration of defective deciduous molar teeth. In the rural districts where kindergartens have not been established as a part of the public school system, it will, of course, be a difficult matter to reach the child of preschool age, but in towns where each school has a kindergarten, the school dentist, public school nurses and the family dentist should cooperate closely in the formation of plans by which children, on their admittance to the kindergarten, should receive mouth examinations and be reexamined at frequent intervals.

It is plain that we have not been dealing with these problems at the ages at which the effective protection and repair of the deciduous teeth can be best accomplished, and, as a matter of social economics, the work should be started at an age at which mouth hygiene activities will be productive of the best results. With this end in view, the scope of the mouth hygiene movement must be broadened to include the children of preschool age.

Dr. Delabarre[1] says, in reference to the whole body of dentists: "They are very willing to leave all these matters to their mouth hygiene committees, or employed health workers. They must be jolted out of their complacency. The profession must be made to see that mouth hygiene has to be practiced in the dental office as well as preached from the house tops."

Our vision of the mouth hygiene movement must be broadened by this step, which will include the child of preschool age.

In view of the fact that there are many parents who cannot afford a family dentist, it is self-evident that for the welfare of the child there should be available dental clinics for those of preschool age, where the services of the general dentist or of the specially trained children's practitioner could be obtained.

But when we have the proper agencies in operation for the examination of the teeth of children of all classes, during the preschool age, the findings and recommendations of such agencies will represent only a useless expenditure of time and money, unless indigent parents

1. Delabarre, F. A.: J. A. D. A., 16:559 (March) 1929.

can be induced to cooperate with dental clinics, and unless those who employ a family dentist insist that he carry out the wishes of the dentists and nurses employed in the mouth hygiene movement.

In any case in which the general practitioner of dentistry questions the soundness of advice given by the public service dentist, the matter should be discussed with him rather than with school patrons; for if the mouth hygiene service is to continue to extend its work of humanitarianism, it must have the loyal support of those patrons, and it is therefore better outwardly to uphold public-service dentists or school nurses than to destroy public confidence in their judgment or general ability.

If we could convince the parents of the danger to the child's health, and consequently to its mental normality, arising from neglect of the deciduous teeth, the problem would be solved in a practical way. To this end, the publication and dissemination of pamphlets carrying photographs of authenticated cases of malformations and pronounced deformities of the jaw, due to lack of preventive measures being carried out prior to the first seven or eight years of a child's life, would undoubtedly prove convincing propaganda, on the theory that "seeing is believing." Such illustrations of neglect are available in every family dentist's practice, and time should be taken to make a tangible record of them.

The well-to-do parent would then approach the family dentist from a reversed point of view. Instead of consulting him with the sole intention of having him advise against the recommendations of the school dentist or nurse, the parent would issue a mandatory order to "Do whatever ought to be done, and do it as soon as possible!"

If the parents did not read English, or were wholly illiterate, visits from the social worker, with explanations of the text and pictures, would in many cases overcome the antagonism of ignorance, and gain consent for the child to receive clinical dental service, for most parents love their children and an appeal to pride is often successful in cases where an argument based on nothing but plain common sense would be without effect.

If physical conditions alone were at stake, every child would be entitled to the possession of a body as nearly perfect as his parents and the community could give him; but as any abnormality of the physical not only weakens resistance to disease in general, but also tends to sap moral defenses, the responsibility of physicians and dentists toward children cannot be stressed too often or too greatly.

The adult criminal is seldom found to have been a normal child. When an understanding cooperation is established between parents, mouth hygiene workers and dentists in general practice, the protection of children in one of the most important phases of their physical, mental and moral well-being will be assured.

Surely a matter of such grave import is worthy of the serious consideration of every general practitioner in dentistry.

It is not the purpose nor is it within the province of this talk to attempt to define and apportion the responsibilities of the intelligent few toward the ignorant many. Its purpose is to induce the general practitioner of dentistry to himself fix and assume his share of such responsibility in the matter of the mouth hygiene of the child.

CURRENT LITERATURE

EXTRACTS AND ABSTRACTS

Mouth Infections in Relation to Systemic Disease: The diagnostic importance and peculiar relationship of certain types of stomatitis to systemic disease is presented by Musser (*California and West. Med.*, September, 1929). The following types are discussed: stomatitis in (1) acute contagious diseases (measles, scarlet fever, diphtheria, varicella, variola and Vincent's infection); (2) deficiency diseases (beriberi, scurvy, pellagra, pernicious anemia and sprue, and (3) diseases with peculiar blood reactions (anemia, hemophilia, chlorosis, infections mononucleosis, acute leukemia, agranulocytic angina, aplastic anemia and purpura hemorrhagica). In some of the acute diseases, the stomatitis is part of the general clinical condition and so is of diagnostic importance. In measles, Koplik's spots are present. In scarlet fever, the tongue shows a bright red tip and edges, with a whitish coating on the dorsum, the disappearance of which in from twenty-four to forty-eight hours confirms the diagnosis. The papillae are enlarged also and the mucous membrane looks almost edematous, being red and glistening. In varicella, ulcers appear occasionally in the buccal mucous membranes. In variola, pustules may form in the mouth and become ulcers. In Vincent's infection sometimes the mouth condition is the only finding in a fatal case. Among the deficiency diseases, xerophthalmia is said to present manifestations in the mouth. Gingivitis sometimes occurs in beriberi. In scurvy, we have oral manifestations, the gums being swollen, painful and discolored, with a tendency to hemorrhage. In pellagra, there is the painful and typical beefy red tongue, with, rarely, inflammation of the mucous membranes. In time, chronic tongue lesions resembling leukoplakia develop. In pernicious anemia, the smooth, glossy bright red tongue, as contrasted to the pale mucous membranes elsewhere in the mouth, is an important diagnostic feature of the disease. In sprue, the tongue resembles somewhat that seen in pernicious anemia and pellagra. As in pernicious anemia, the acute stages show the smooth red glistening tongue. In the chronic recurrent type of sprue, the tongue is often badly cracked and fissured. In all the deficiency diseases mentioned, except possibly beriberi, blood changes are a consistent feature. Among disease showing peculiar blood reactions, anemia shows a true stomatitis occasionally. In hemophilia, we frequently have capillary oozing from the gums. In chlorosis, now rarely seen, the gingival margin has a bluish tinge, caries progresses rapidly and there is a tendency to periodontal involvement. Infectious mononucleosis presents throat lesions, enlargement of the cervical and other glands, with reduction of granulocytes and increase in mononuclear cells. The etiology is unknown and there may be no relationship between the condition and other mouth lesions. Ulcerative mouth lesions are almost invariably present in acute leukemia. The organisms of Vincent are always found. The blood picture shows increase of immature leukocytes and decrease of the normal adult cell. In agranulocyte angina, Vincent's organisms and spirochetes are almost invariably present. There is necrotic inflammation of the mucous membrane associated with hypogranulocytosis, but which is the causative factor in the other is not known. Aplastic anemia, a rare condition, is associated with ulcerative mouth lesions, as is purpura hemorrhagica. The author concludes that in acute contagions, mouth changes are of diagnostic importance. In deficiency diseases, except rickets, mouth lesions occur with peculiar regularity and they are most certainly of diagnostic significance. In abnormal blood conditions, the presence of mouth lesions suggests a relationship between the blood and mouth diseases.

Unusual Tumor of Maxilla: Amies (*Australian J. Dent.*, Aug. 1, 1929) reports an unusual tumor of the maxilla which occurred

in a boy, aged 17, who had four months previously had all his upper and several lower teeth extracted under general anesthesia. One month after the extraction, a painless swelling was noted in the right maxilla. This increased and, on examination, the right side of the face was much swollen. There was no pain or tenderness, and the general condition was good. The tumor was about the size of a pigeon's egg and was extremely hard. The mucous membrane was slightly reddened from the cuspid to the first molar region. There was no glandular involvement, and the roentgen ray revealed only apparent condensation of bone. The tumor was explored under intratracheal anesthesia and a large amount of avascular material resembling "bone sawdust" was removed from its center. The antrum floor and buccal and lingual plates of the maxilla were intact. On examination "mature connective tissue containing islands of active bone cells" was found, but it was the opinion that the tissue could not definitely be called sarcomatous. Six weeks after operation, the tumor had not decreased in size, and six radium needles were implanted for four days. No change was apparent for six weeks; but during the seventh week, the facial swelling almost disappeared and the tumor decreased accordingly. At the time the report was made (ten weeks after operation), the tumor was half its original size, and it was expected that dentures could be fitted after another month.

Cancer as a Public Health Problem: One of the objections toward the development of organized attack on the cancer question has been the fact that we do not know the cause of cancer. We have no satisfactory proof of the nature of malignant proliferation of tissue cells. Neither have we any definite knowledge of the nature of normal growth; we merely have descriptive knowledge of the conditions under which it occurs. We know that the ovum, when fertilized, grows under certain conditions, but we do not know why it grows. I think, therefore, that the problem of the ultimate nature of the cancer process is one of those types of information which will long escape the human mind. In the present state of science, I think it is unsolvable; but the fact that the ultimate cause of cancer is unknown has little practical bearing upon our cancer problems of the present day. The important thing to know today is that the exciting factors of the major forms of cancer are perfectly well known, are very simple, and are often controllable. The old French clinicians thought cancer of the mouth, which kills 3,500 yearly in the United States, was caused by tobacco, bad teeth, and syphilis, and that if these three exciting factors were removed, cancer of the mouth would disappear. Instead of waiting for sensational discoveries in biology, we ought to be acquainting ourselves with these exciting factors in the major forms of human cancer which are accessible, controllable, and which, if dealt with intelligently, would result in a reduction in the incidence of cancer. On the whole, there is a very substantial body of knowledge regarding the various forms of chronic and specific irritation which are known to be necessary to the incidence of cancer. The exciting causes of several of the major forms of cancer are numerous and very commonplace. One conclusion that can be drawn from such information is that cancer is a public health problem of the first importance, because many of the forms of cancer are preventable, and if the public were thoroughly informed, a definite reduction in the incidence of cancer might follow. Another difficulty arises in the conflicting opinions as to the best methods of attacking the cancer problems. One group feels that we must confine ourselves to laboratory research, discuss the ultimate cause of cancer, pursue chemistry, biochemistry, and physics, and that most of the efforts should be devoted to this type of investigation. I am not of that opinion. I do not see in the near future any likelihood of any discovery in these fundamental sciences which will throw a great light upon the cancer problem or put us in control of any essential factor in the cancer process. It will still remain necessary to pick out the particular chronic irritants and combat them. We shall still be hewers of wood in finding these common causes and types of irritation, acquainting the public with them, and thus attempting to reduce the incidence of the disease.—James Ewing in *Pub. Health Rep.*, Aug. 30, 1929.

Focal Infection and Ocular Disease: The part which dental sepsis plays in ocular disease was brought into prominence many years ago by Mr. William Lang, and since then the importance of dental infection in bringing about many diseased conditions of the eye has been recognized by most ophthalmologists. At the Annual Meeting of the British Medical Association the Section of Ophthalmology again discussed the question of focal infec-

tion and diseases of the eye. The discussion seems to have been a very full one and there was a general consensus of opinion that focal sepsis played a very important part in ocular disease. The discussion was opened by Mr. MacCallan, who considered that dental sepsis might effect the eye through three paths: by direct extension, by lymphatic absorption, and by absorption from the alimentary canal. In Mr. MacCallan's view, meibomian cysts and dendritic ulcers were especially associated with dental sepsis.—*Brit. Dent. J.*, Sept. 16, 1929.

Unerupted Teeth: All teeth may fail to erupt. In the author's study, the frequency of unerupted teeth was from 0.4 to 0.8 per cent, the tooth most commonly unerupted being the upper lateral incisor in the female; endocrine stigmas were a marked feature, especially thyroid and gonadal disturbances, and harelip and cleft palate did not necessarily occur in the offspring of a mother with unerupted lateral incisors. Infection and suppuration of deciduous teeth may destroy the buds of the permanent teeth. In children with an unerupted tooth, other anomalies are frequently found. The author states his belief that an unerupted tooth is merely another anomaly.—William Lintz, *M. J. & Rec.* (June) 1929; abstr. *Am. J. Dis. Child,* September, 1929.

FOREIGN LITERATURE

Anthropology (Rudolf Schwarz, Fortschr. d. Zahnheilk., No. 9, 1929, p. 747): A new impression material known under the name of "Negocoll" has been perfected by Poller. This is a hydrocolloid substance used for taking impressions of portions of the living body, and particularly good for making facial masks. On account of the elasticity of the material, it is easy to take impressions of undercuts; and it is even possible to take impressions of the anterior teeth in which the mouth is open, in conjunction with full face impressions. This material was used, in this study, for the purpose of making facial masks of developing individuals of different ages. For the study of the normal development of the face and jaws, 2,066 individuals were examined, of whom 149, or 7.2%, were normal and suitable for study. In order to comprehend the development of the skull properly, it is necessary to know the relative rate of development of the various parts. Measurements of the width and length of the head, the morphologic length of the face, size of the ears, size of the nasal openings, etc., were obtained for the purpose of finding what corelation there exists between the development of the jaws, the teeth and facial form. Among many other things, it was possible to show that the first permanent molar undergoes the greatest change of position (*Wachstumverschiebung*) during development. Developmental changes of the profile are illustrated by photographs, charts and masks. Orthodontists especially should be interested in this article. EMIL MUELLER, Chicago.

Embryology and Histology (Balint Orban, Fortschr. d. Zahnheilk., No. 9, 1929, p. 771): Tooth development belongs to one of the most difficult chapters of embryology, largely because material for study is so difficult to obtain. It is absolute folly to attempt the study of tooth development with individual sections. Complete serial sections prepared from well fixed material from all three planes are essential. With this material available, it is not possible to understand all sections unless models are constructed. The thickening of the mouth epithelium marks the beginning of tooth development. This is supposed to take place in embryos about 11 mm. long, corresponding in age to from 34 to 38 days. Five series of embryos ranging between 11 and 12 mm. were examined but showed no signs of thickening (*Zahnanlage*). The first signs of thickening were found in embryos 13.44 mm. and up. The tooth does not develop as previously supposed. The epithelium does not grow into the depth to develop the tooth germ. The thickened epithelium marks approximately the fixed point from which the tooth germ and tooth develops occlusally. Once the crown has developed, the roots do not develop by growing into the tissue but rather by the crown being pushed away from Hertwig's epithelial sheath, the relatively fixed point. . . . With serial sections from rat jaws, it was possible, with the aid of projected serial drawings, to show the order of the bifurcation development. The bifurcation is determined long before the crown development is completed. The roots are first outlined by eccentric peripheral enlargement of the basal opening of the tooth germ. In this eccentric growth, certain portions of Hertwig's epithelial sheath remain relatively fixed, though later these projections enlarge and unite to form the bifurcation which demarcates the roots.

EMIL MUELLER, Chicago.

Errors in Operative Dentistry (Otto Hubner, Fortschr. d. Zahnheilk., No. 9, 1929, p. 476): Calcium metabolism in the human organism is intimately connected with the vitamin problem. The demands of expectant mothers for diets that favorably influence the development of the skeleton and teeth should not be met with the prescribing of calcium preparations in tablet form, but rather with the recommendation of diets rich in calcium, such as milk and particularly vegetables. Such diets should also be advocated for children of preschool and school age. . . . With reference to the care of teeth of children, it is hardly possible to instruct them too early in cleaning their teeth as well as instructing them in proper habits of mastication. That consumption of confections and chocolate is still on the increase is true of young and old, of rich and poor. Dentists and pediatricians are urged to become more active against this evil. To prevent dental troubles children should be brought to dentists early, before any real need exists; and the teeth should be cleaned in order that the young patient may have an opportunity to become accustomed to the dentist and his surroundings. . . . Dentin anesthesia for the preparation of teeth for restorations as a general procedure is contraindicated, particularly the use of the nervocidin of Dalma and Palozzi.

EMIL MUELLER, Chicago.

MISCELLANY

BOOK REVIEWS

Fundamentals of Pathology. By Joseph Schroff, B.S., D.D.S., Associate Professor of Oral Pathology, School of Oral and Dental Surgery, Columbia University; Dental Surgeon in Charge of Oral Surgery, Mt. Sinai Clinic; Consulting Oral Surgeon, Jewish Memorial Hospital; Attending Oral Surgeon, German Polyclinic Hospital; Former Assistant Attending Oral Surgeon, Presbyterian Hospital; Former Assistant Attending Oral Surgeon. Vanderbilt Clinic. Illustrated; 109 pages; price, $2.50. Published by William Albert Broder, New York.

This book was written chiefly for the dental hygienist, and it is commended to her careful consideration. Manifestly, in a book of this size treating a subject as broad as pathology, the author would be obliged to limit himself closely to the bare fundamentals and this he has done quite consistently. As he states, the book is "a simplified outline of what is common knowledge of pathology in medicine and dentistry." It is therefore a ready means of renewing the subject available not only to the hygienists but to practitioners of dentistry as well. It is well printed on good paper and the mechanical makeup of the volume is satisfactory.

Outline of Bacteriology. By Henry A. Bartels, B.S., D.D.S., Lecturer on Bacteriology. School of Oral Hygiene, Columbia University.—Instructor, Department of Oral Pathology, School of Dental and Oral Surgery, Columbia University; Attending Dental Surgeon, Bryson Day Nursery; Assistant Bacteriologist, Division of Laboratories and Research, New York State Department of Health; formerly Bacteriologist, United States Public Health Service. 47 illustrations; 128 pages; price, $2.00. Published by William Albert Broder, New York.

This book is the outgrowth of a series of lectures given by the author and the subject matter is condensed into the smallest possible compass. It is therefore, as the name implies, a mere outline, and is consequently valuable as a means of reviewing the salient points of the subject to refresh the memory or to prepare for an examination. To this end, there is, at the close of some of the chapters, a list of questions bearing on the subject matter, making it quite easy to review the material in the most expeditious manner.

The volume is for the most part made up of material found in the standard textbooks and the subject is condensed and arranged for convenient reference.

Our Face from Fish to Man. A Portrait Gallery of Our Ancient Ancestors and Kinsfolk Together with a Concise History of Our Best Features. By William K. Gregory, Professor of Vertebrate Paleontology and Curator of the Departments of Ichthyology and Comparative Anatomy, American Museum of Natural History; Member of the

National Academy of Sciences, Etc. With a foreword by William Beebe; 119 illustrations; 295 pages. Published by G. P. Putnam's Sons, New York and London, 1929.

The first sentence in the preface to this book is pithy and illuminating. It says: "According to popular standards of civilized peoples, men of one's own race and tongue were called 'men,' 'warriors,' 'heroes,' but people of other races were 'barbarians,' 'unholy ones,' 'foreign devils.'" And the reviewer would like to ask how far have we advanced from that concept to this day? Does it not have a familiar ring even in as brief a time ago as the recent madness known as the Great World War?

This book discusses in a frank and lucid manner the particular phase of evolution having to do with the development of the human face, and it therefore should be of particular interest to dentists. We wonder if our orthodontists might not get some suggestion of light on their various problems of delving in this book and studying the background of the present day human countenance.

The illustrative material of the book is rich and varied, and it is a great aid in interpreting some portions of the text which, without illustrations, would be rather difficult to the "lay" mind; and let us be frank: when it comes to works of this scientific character, most members of the dental profession (as well as of other professions) must be listed in the "lay" class. This does not mean that Dr. Gregory's book is at all dull or abstruse. He starts with the somewhat staggering statment: "For a billion years or more, the ceaseless game of life has been concerned with the capture and utilization of energy for the benefit of the individual and with the rhythmic storage and release of energy for the reproduction of the race." A billion years! No wonder there has been some confusion about the origin and development of the human race; no wonder there has been opposition to the idea of evolution on the part of those who did not care to study the question with a mind open to the passing of a great period of time.

With some scientific subjects, the more we study, the farther we are led into a labyrinth of confused ideas, but with evolution properly pursued, this is not the case. More and more, thanks to the investigations of our scientists, the light is let in on the sources of our being and we are given a more intelligent conception of our origin. "Our Face from Fish to Man" is one more attempt in this direction, and the result is very satisfying.

The book is well printed, on excellent paper and with good type, and is a credit to the bookmaker's art.

NEWS

Idaho Association Elects Officers: The following have been elected officers of the Idaho State Dental Association: president, B. M. Brookfield, Idaho Falls; president elect, H. B. Colver, Boise; secretary, A. G. Friedline, Boise; treasurer, T. L. Cartney, Filer. The next annual meeting will be held in Idaho Falls, probably in June.

DEATHS

Bell, Walter J., Los Angeles, Calif.; University of Michigan, College of Dentistry, 1892; was fatally injured in an automobile accident, September 2.

Bentley, Charles Edwin, Chicago, Ill.; Chicago College of Dental Surgery, 1887; died, October 13; aged 70.

Edgers, E. E., Seattle, Wash.; Baltimore College of Dental Surgery, Dental School, University of Maryland, 1892; died September 23.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

NATIONAL SOCIETIES

American Dental Association, Denver, Colo., July, 1930.

American Dental Society of Europe, Nice, France, April 21, 1930.

Dental Protective Association of the United States, Chicago, Ill., Dec. 16, 1929.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

January (1930)

Pennsylvania (Midwinter), at Harrisburg (30-31).

April (1930)

Connecticut, at Stamford (22-24).

May (1930)

New York, at New York City (12-16).
North Carolina, at Asheville (5-8).
Pennsylvania, at Philadelphia (6-8).

First District Dental Society of New York, Dec. 10-14, 1929.

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

Connecticut, at Hartford, November 18-21. A. J. Cutting, Recorder, Southington.

Indiana, at Indianapolis, November 11. J. M. Hale, Secretary-Treasurer, Mt. Vernon.

Michigan, at Ann Arbor, January 6-11. J. W. Lyons, Secretary, 617 Dwight Bldg., Jackson.

Minnesota, at Minneapolis, December 13. F. E. Cobb, Secretary, 601 Donaldson Bldg., Minneapolis.

New Jersey, at Trenton, December 2-7. John C. Forsyth, Secretary, 148 W. State St., Trenton.

Pennsylvania, at Philadelphia and Pittsburgh, December 4-7. Alexander H. Reynolds, 4630 Chester Ave., Philadelphia.

Rhode Island, at Providence, December 3-5. Albert L. Midgley, Secretary, 1108 Union Trust Bldg., Providence.

Virginia, at Richmond, November 4. John M. Hughes, Secretary, 715 Medical Arts Bldg., Richmond.

PENNSYLVANIA STATE DENTAL COUNCIL AND EXAMINING BOARD

The next regular examination of the Pennsylvania State Dental Council and Examining Board will be held in Philadelphia and Pittsburgh, Wednesday-Saturday, December 4-7. The theoretical examination in Philadelphia will be held in Room 976, City Hall, and the practical examination at Temple University, Eighteenth and Buttonwood streets. Both the theoretical and the practical examinations in Pittsburgh will be held at the University of Pittsburgh. The examination in practical operative work will be held on Saturday at 8:30 o'clock, and the practical examination in prosthetic work on Saturday at 1:30 o'clock.

An examination for hygienists will be held in the same places, Thursday-Saturday, December 5-7.

Application papers can be secured from the Department of Public Instruction, Harrisburg.

ALEXANDER H. REYNOLDS, *Secretary,*
4630 Chester Ave.,
Philadelphia.

AMERICAN DENTAL SOCIETY OF EUROPE

The next annual meeting of the American Dental Society of Europe will be held at the Negresco Hotel, Nice, France, April 21, 1930. A cordial invitation is extended to all and

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

those desiring to attend or present papers or clinics are requested to communicate with

J. DAWSON BUCKLEY, *Secretary,*
25 Blvd. Victor Hugo,
Nice, France.

L. J. MITCHELL, *President.*

DENTAL PROTECTIVE ASSOCIATION OF THE UNITED STATES

The annual meeting of the Dental Protective Association of the United States will be held at the Palmer House, State and Monroe streets, Chicago, Ill., on the third Monday in December (16), at 4 p. m. The report of the officers will be given; a board of directors will be elected, and such other business as should come before the association will be transacted. All members are urgently requested to be present.

By order of the board of directors,

J. G. REID, *President,*
D. M. GALLIE, *Vice President-Treas.*
E. W. ELLIOT, *Secretary,*
55 E. Washington St.,
Chicago, Ill.

MICHIGAN STATE BOARD OF DENTISTRY

The Michigan State Board of Dentistry will hold its next regular examination for the purpose of licensing dentists and dental hygienists to practice in Michigan, January 6-11, at the Dental College of the University of Michigan, Ann Arbor. Applications must be on file in the secretary's office thirty days before the date of examination. For further information, address

J. W. LYONS, *Secretary,*
617-621 Dwight Bldg.,
Jackson.

PENNSYLVANIA STATE DENTAL SOCIETY

The sixty-second annual meeting of the Pennsylvania State Dental Society will be held in Philadelphia, May 6-8.

Z. T. JACKWAY, *President,*
1506 E. Susquehanna Ave.,
Philadelphia.

RHODE ISLAND BOARD OF REGISTRATION IN DENTISTRY

A meeting of the Rhode Island Board of Registration in Dentistry for the examination of candidates will be held at the State House, Providence, Tuesday-Thursday, December 3-5, beginning each day at 9 a. m. Candidates shall present to the secretary of this board, at least one week before the examination, a written application on a form provided by the board together with the examination fee of $20.

ALBERT L. MIDGLEY, *Secretary,*
1108 Union Trust Bldg.,
Providence.

GREATER NEW YORK DECEMBER MEETING FOR BETTER DENTISTRY

Plans are rapidly approaching completion for the Greater New York December Meeting for Better Dentistry, which will be held at the Hotel Pennsylvania, New York City, December 9 to 13, under the auspices of the First and Second District Dental societies. This, the Fifth Annual Meeting, bids fair to be the largest and best which has thus far been held. The clinic program for the registered clinics will be ready for distribution about November 15, and owing to the growing popularity of this meeting, it will be advisable to make reservations as early as possible.

The meeting will be conducted on the same plan as previous meetings; namely, $5.00 admits members to all lectures, clinics, etc.

The following essayists and clinicians have accepted invitations to be present: R. Boyd Bogle, Nashville, Tenn.; Wallace Seccombe, Toronto, Canada; J. R. Blayney, Chicago, Ill.; Chalmers J. Lyons, Ann Arbor, Mich.; Charles Lane, Detroit, Mich.; Albert L. LeGro, Detroit, Mich.; Dayton D. Campbell, Kansas City, Mo.; James M. Prime, Omaha, Nebr.; Hugh W. MacMillan, Cincinnati, Ohio; P. Kyprie, Detroit, Mich.; John LaDue, Chicago, Ill.; Theodore W. Maves, Cleveland, Ohio; Carlos H. Schott, Cincinnati, Ohio; Emory C. Thompson, Buffalo, N. Y.; Joseph L. Ubl, Chicago, Ill.; Matthew N. Federspiel, Milwaukee, Wis., and Austin F. James, Chicago, Ill.

There will be a manufacturers' exhibit held in the Roof Garden and Salle Moderne of the hotel during this meeting.

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